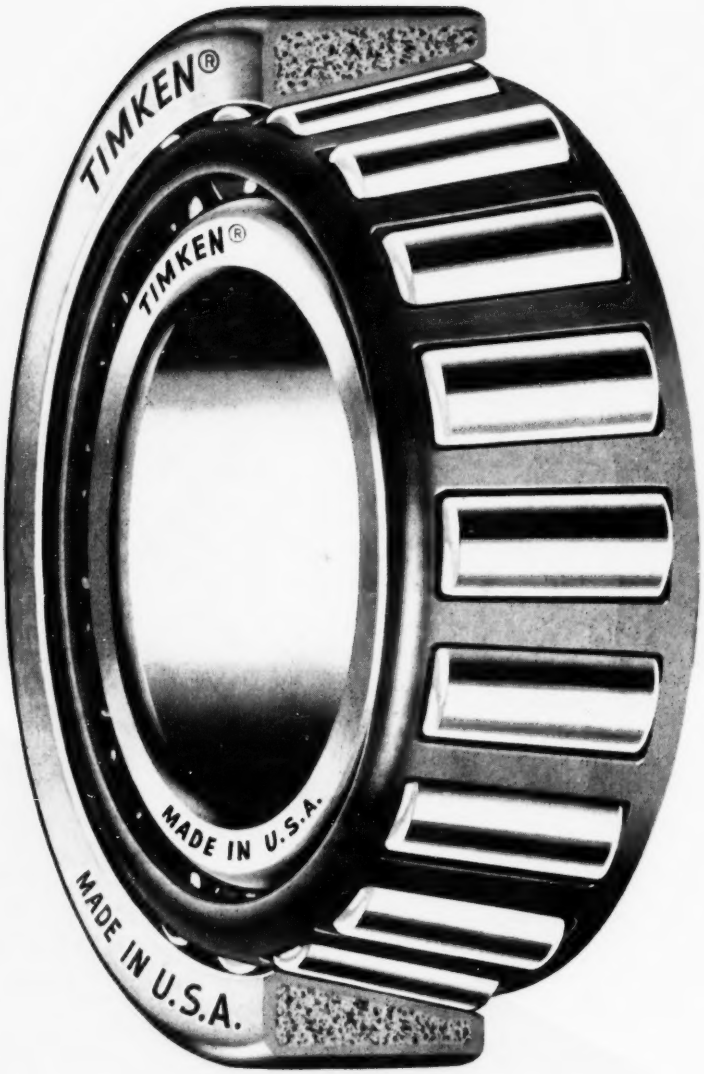
AUTOMOTIVE PRODUCTION NUMBER — NOVEMBER, 1953

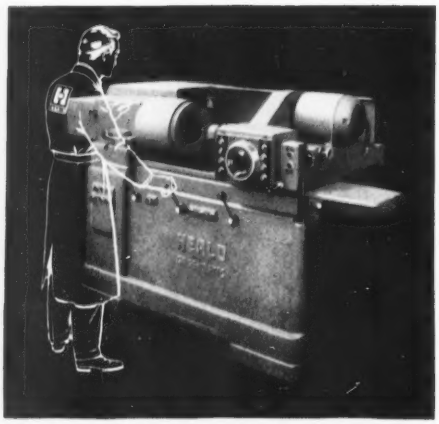
MACHINERY



This symbol on a product means its bearings are the best

Tapered Roller
TIMKEN BEARING
EQUIPPED

Heald Internal outproduces older equipment by nearly



This Heald Model 271 Gage-Matic grinds ring gear bores nearly as fast as two older machines.

THIS might be just another case history, except for one thing — a production increase of almost 100 per cent. And that's a pretty important saving in any production man's language.

A Heald Model 271 Gage-Matic was installed by an automotive manufacturer for grinding the bore of differential ring gears. A simple, straightforward operation — yet it was found that this new Internal out-produced *two* older machines by almost two-to-one! Why? Because all of the new Heald machines have been designed to save time and effort on *every phase* of the operating cycle. It all adds up to a substantial increase in production efficiency.

Remember — when it comes to precision finishing, it pays to come to Heald.

Internal and Rotary Surface Grinding Machines and Bore-Matics

HEALD

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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MACHINERY

VOLUME 60 NOVEMBER, 1953 NUMBER 3

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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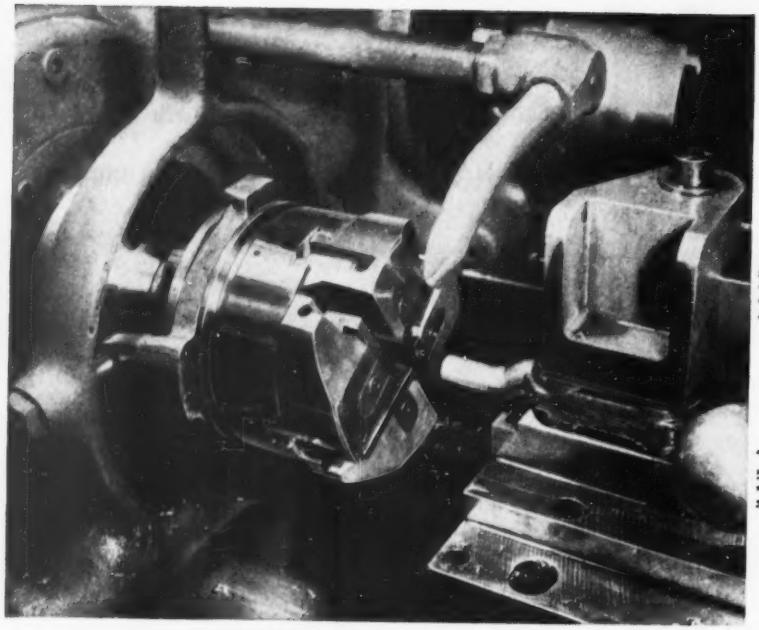
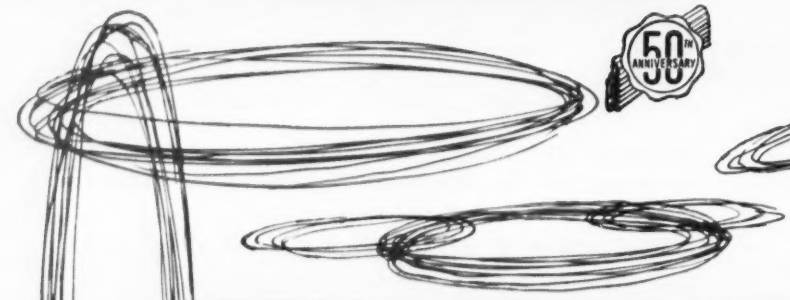
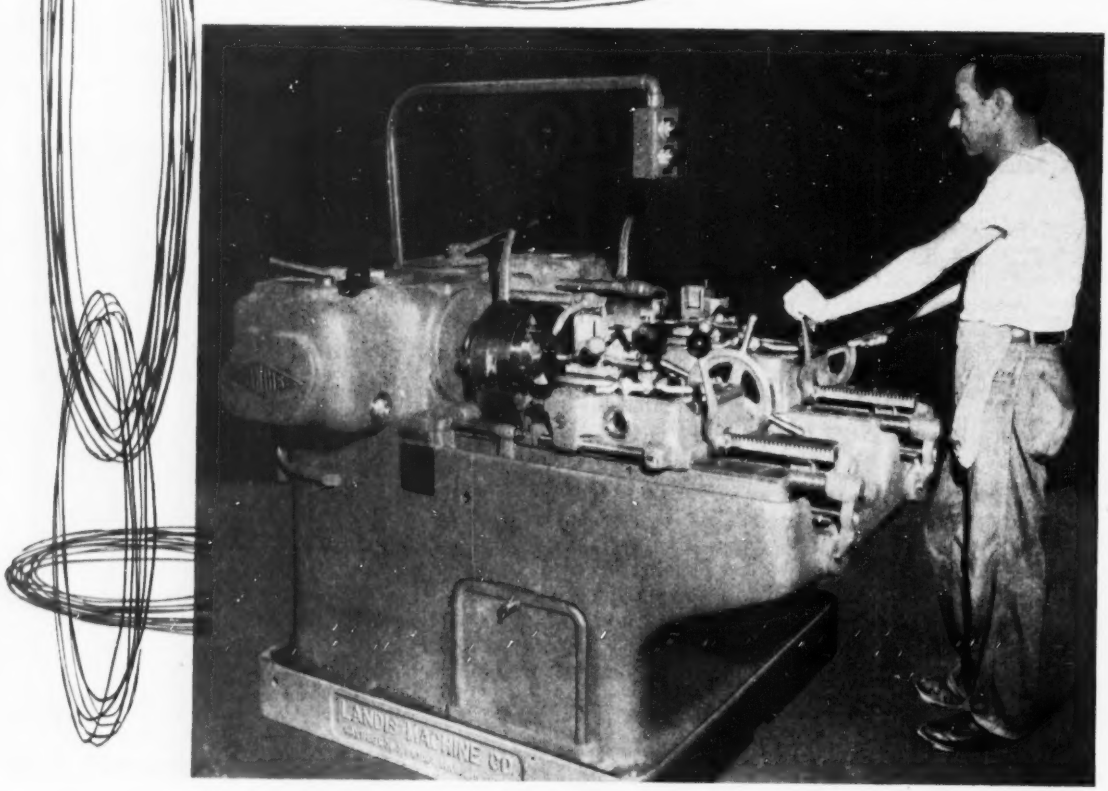


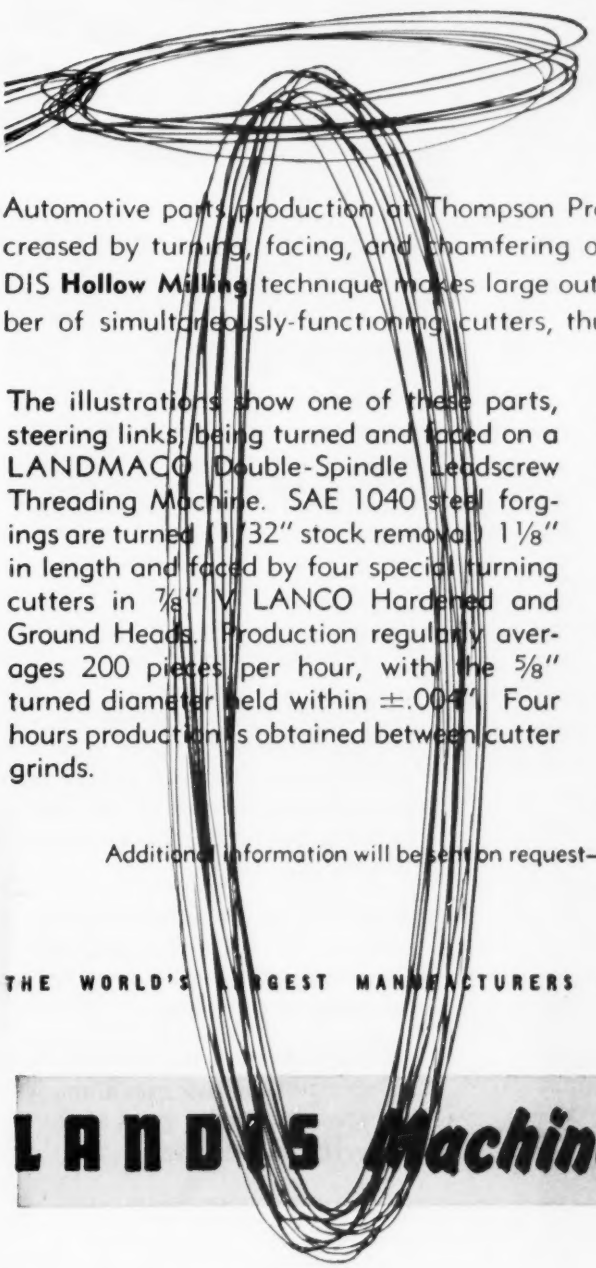
50TH ANNIVERSARY





FASTER TURNING

Using 4 Cutting Tools



SIMULTANEOUSLY

Automotive parts production at Thompson Products in Detroit has been substantially increased by turning, facing, and chamfering on Landis Threading Machines. This LANDIS **Hollow Milling** technique makes large out-put increases possible by applying a number of simultaneously-functioning cutters, thus multiplying the feed rate of a single tool.

The illustrations show one of these parts, steering links, being turned and faced on a LANDMACO Double-Spindle Leadscrew Threading Machine. SAE 1040 steel forgings are turned (1/32" stock removal) 1⅛" in length and faced by four special turning cutters in ⅞" V LANCO Hardened and Ground Heads. Production regularly averages 200 pieces per hour, with the ⅝" turned diameter held within ±.004". Four hours production is obtained between cutter grinds.

This LANDIS technique offers important advantages over other methods of turning, forming, and facing. The use of four or six simultaneously-functioning cutters, in addition to increasing production, reduces tool cost and workpiece spoilage to the minimum. The diametrically-opposing cutters evenly distribute cutting strains and maintain proper work alignment. LANDIS Cutters, available in a wide variety of styles, are economical for they are usable for most of their length with only a simple regrinding of the rake angle.

Additional information will be sent on request—please include specifications when writing.

THE WORLD'S LARGEST MANUFACTURERS OF THREAD GENERATING EQUIPMENT

LANDIS Machine CO. WAYNESBORO PENNSYLVANIA

H2-C

Today's Trend in Machine Tool Design:-

10 STATIONS
...all on One Part, or on 2 to 10 Different Parts

For Instance

- On different sizes in combination, 4 different size pump rotors at the same time on one machine. Feeds and strokes per minute different for each of the four parts. Synchronized production for 1 rotor every 10 seconds.
- Right and left hand helical pinions, five stations for each, rough and finish cut. Parts come off the machine at the rate of one every 21.4 seconds.
- All stations on one part, cutting 54 internal spur teeth in cast iron drum. A single cut produces quality gears at the rate of one every 26.7 seconds.

TWENTY ONE

Fellows No. 10 Rotary Gear Shapers have been delivered since their introduction in 1947.
All are turning out automotive gears and parts at high production rates with maximum flexibility.

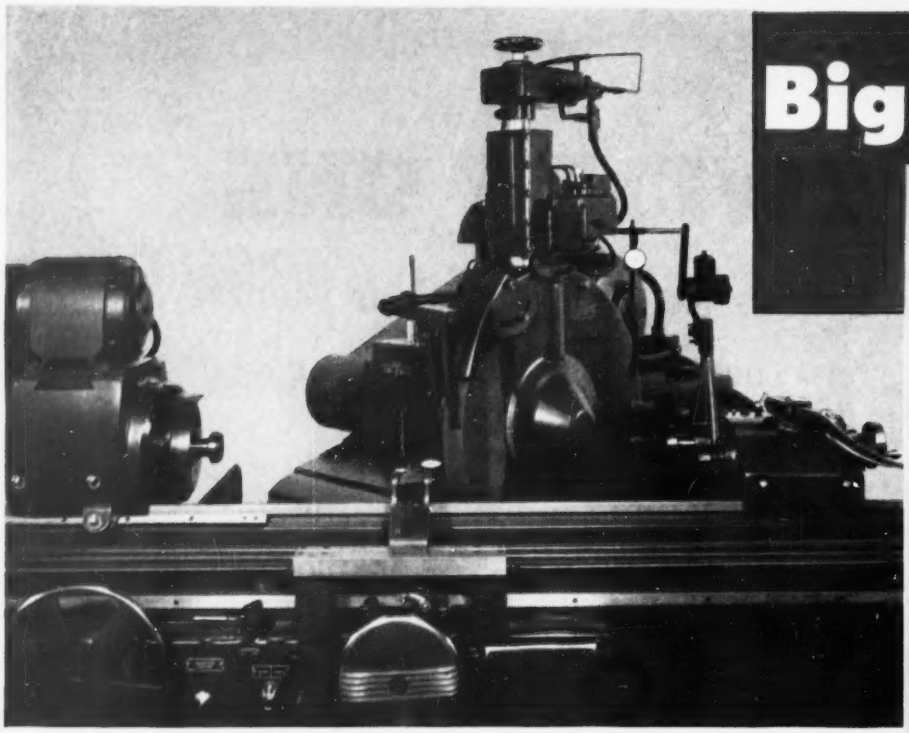
ELEVEN

more on order and under construction testify to the continued acceptance of this machine and its ability to turn out identical parts on all stations or ten different parts on the same self-contained production unit.

THE *Fellows* GEAR SHAPER COMPANY

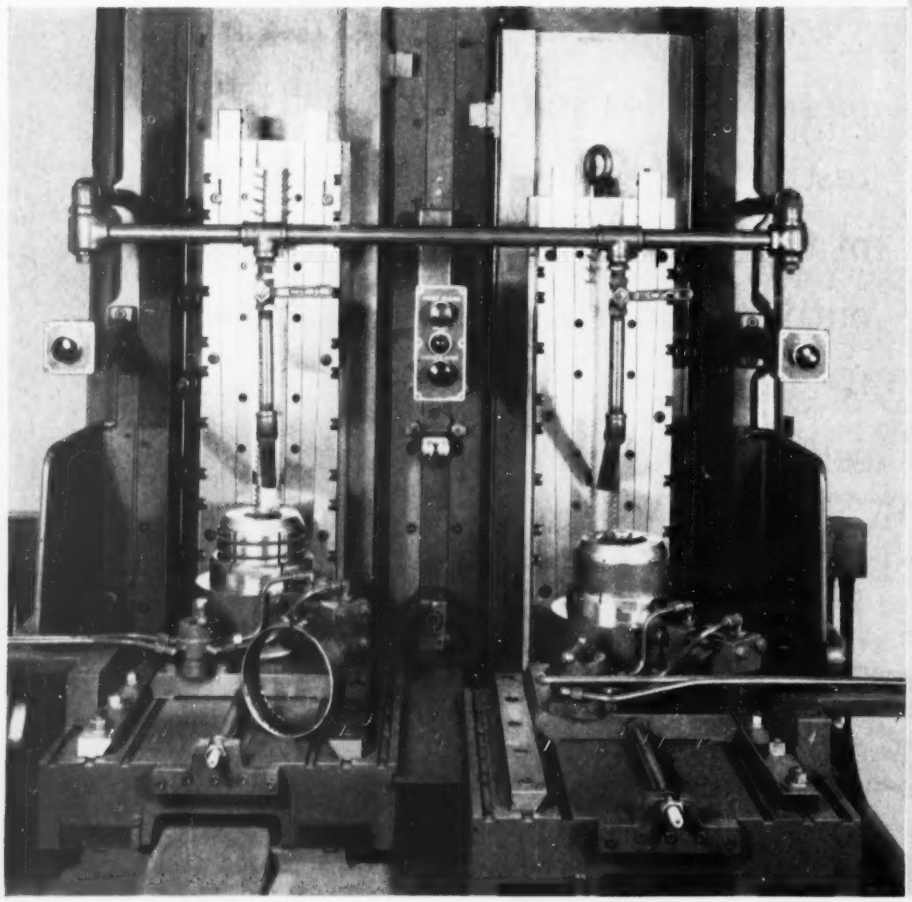
Head Office & Export Department: 78 River Street, Springfield, Vermont
Branch Offices: 323 Fisher Building, Detroit 2 • 5835 West North Ave., Chicago 39
2206 Empire State Building, New York 1

Big-Name



CINCINNATI FILMATIC 14"-L Plain Hydraulic Grinding Machine with extra equipment developed especially for grinding a diameter and adjoining shoulder. Equipment includes 45° angular wheelhead, over-the-wheel automatic profile truing, and "flagging" device for locating shoulder in relation to wheel.

FILMATIC



CINCINNATI No. 10-54 Duplex Vertical Hydro-Broach Machine, tooled up to broach transmission bands.

Material:
Steel

Operation:
Broach 41° angular grooves

Stock removal:
From solid

Production:
283 per hour

CINCINNATI

Industries *deserve* Big-Name Equipment

You can depend upon Cincinnati Milling to build the finest machine tools for the production of automotive components at the lowest cost. Standard metalworking equipment and allied products bearing the CINCINNATI trade-mark include many sizes and styles of machines for milling, broaching, die sinking, cutter sharpening, grinding, lapping, flame hardening, and metal forming; also cutting fluid, and grinding wheels. Transfer type, single-purpose and completely special machine tools are built to your specifications. Three examples are illustrated here. You are cordially invited to visit us and talk over your metalworking problems. Meanwhile, if you would like to learn more about our line of standard products, look in Sweet's Machine Tool File or ask for our General Catalog, publication No. M-1776.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

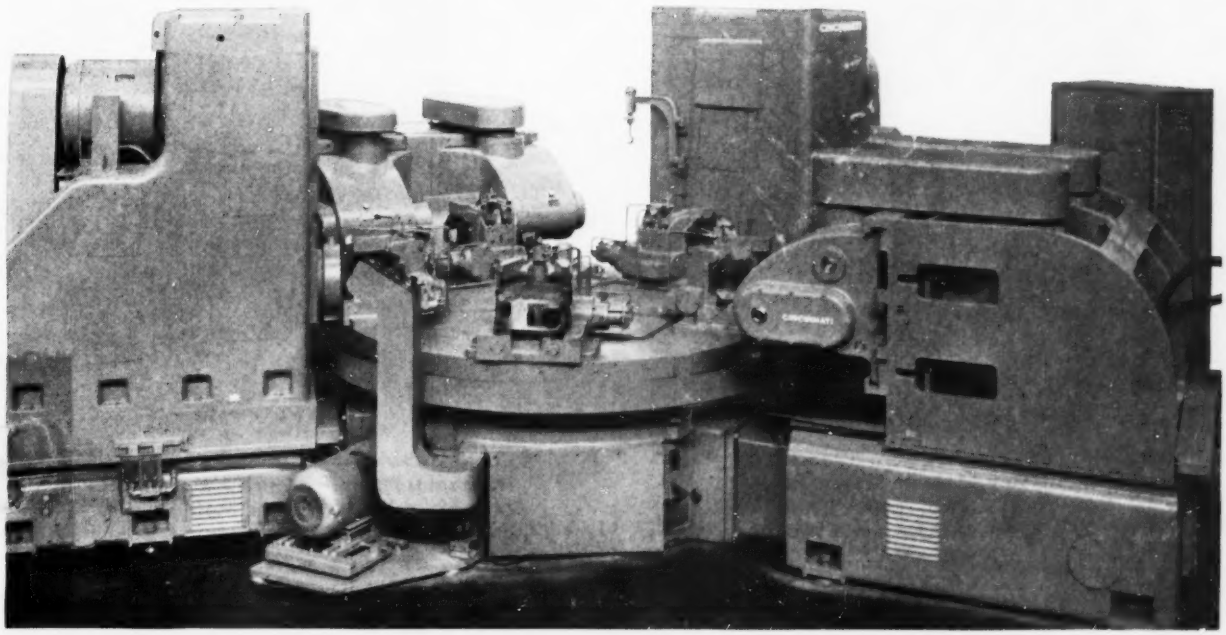
CINCINNATI Station Type Automatic Milling Machine, for milling the ends and one side of transmission cases.

Material:
Cast iron

Operation:
Rough and finish mill two ends and one side

Stock removal:
$3/16$"

Production:
68 parts per hour



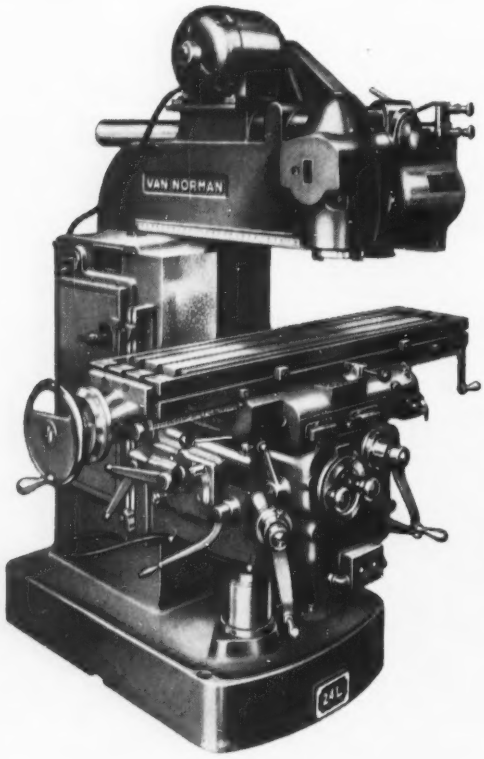
CINCINNATI

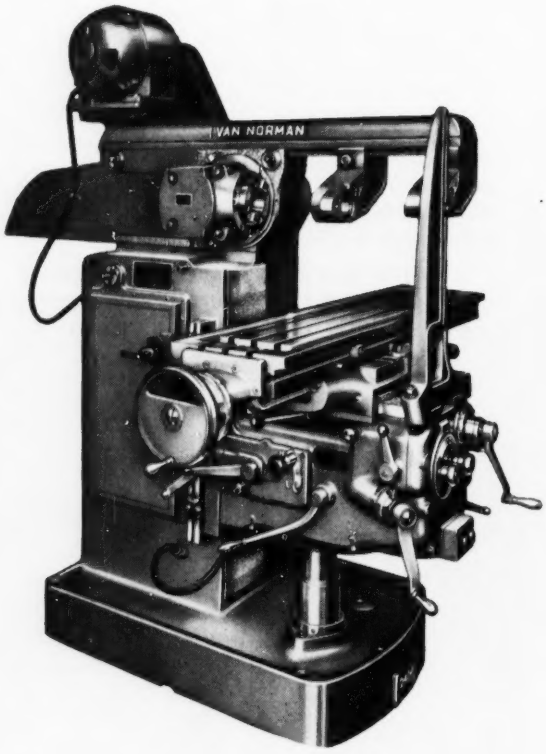
MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

For more information on products advertised, use Inquiry Card, page 261

Announcing 4 Completely New...

VAN





No. 24 L

Cutterhead in Vertical Position
Table: 45″ x 10½″
Ram Travel: 29″

9 Speeds: 50 to 1400 R.P.M
Spindle Motor: 3 H.P.
Feed Motor: 1 H.P.
Approximate Weight: 3700 lbs.

No. 24 M

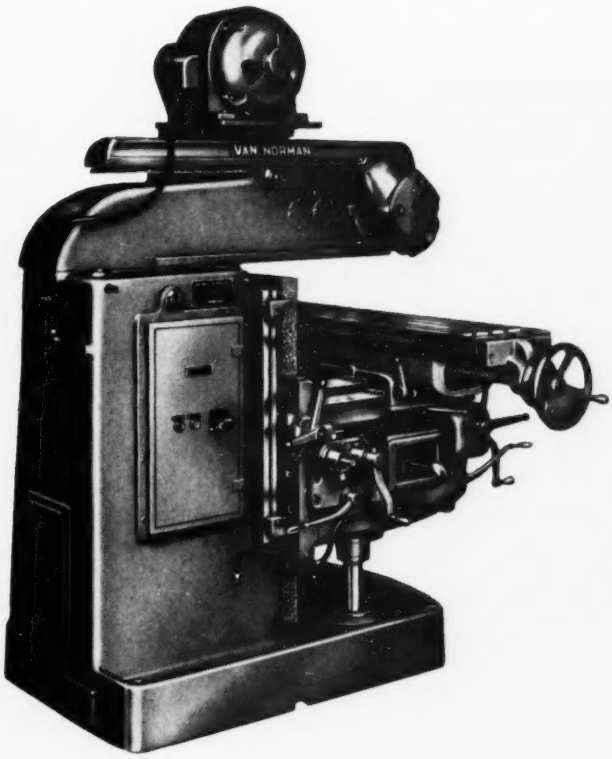
Cutterhead in Horizontal Position
Table: 50″ x 12″
Ram Travel: 25″

12 Speeds: 40 to 1600 R.P.M.
Spindle Motor: 5 H.P.
Feed Motor: 1 H.P.
Approximate Weight: 4000 lbs.

VAN NORMAN COMPANY, SPRINGFIELD 7, M

NORMAN Ram Type Millers

Each Designed to Provide Greater Versatility, Cut Milling Costs:



No. 28

Cutterhead in Angular Position
Table: 58″ x 13″
Ram Travel: 29″

12 Speeds: 40 to 1600 R.P.M.
Spindle Motor: 7½ H.P.
Feed Motor: 1½ H.P.
Approximate Weight: 6300 lbs.

No. 38 M

Cutterhead in Horizontal Position
Table: 64″ x 14″
Ram Travel: 29″

12 Speeds: 35 to 1400 R.P.M.
Spindle Motor: 7½ H.P.
Feed Motor: 1½ H.P.
Approximate Weight: 7200 lbs.

MASS.

These new Van Norman Millers feature the famous adjustable cutterhead which permits conventional horizontal and vertical as well as angular milling on one machine. They have been completely designed and engineered to provide utmost accuracy plus long operating life.
Write for complete information.

Eliminates Extra

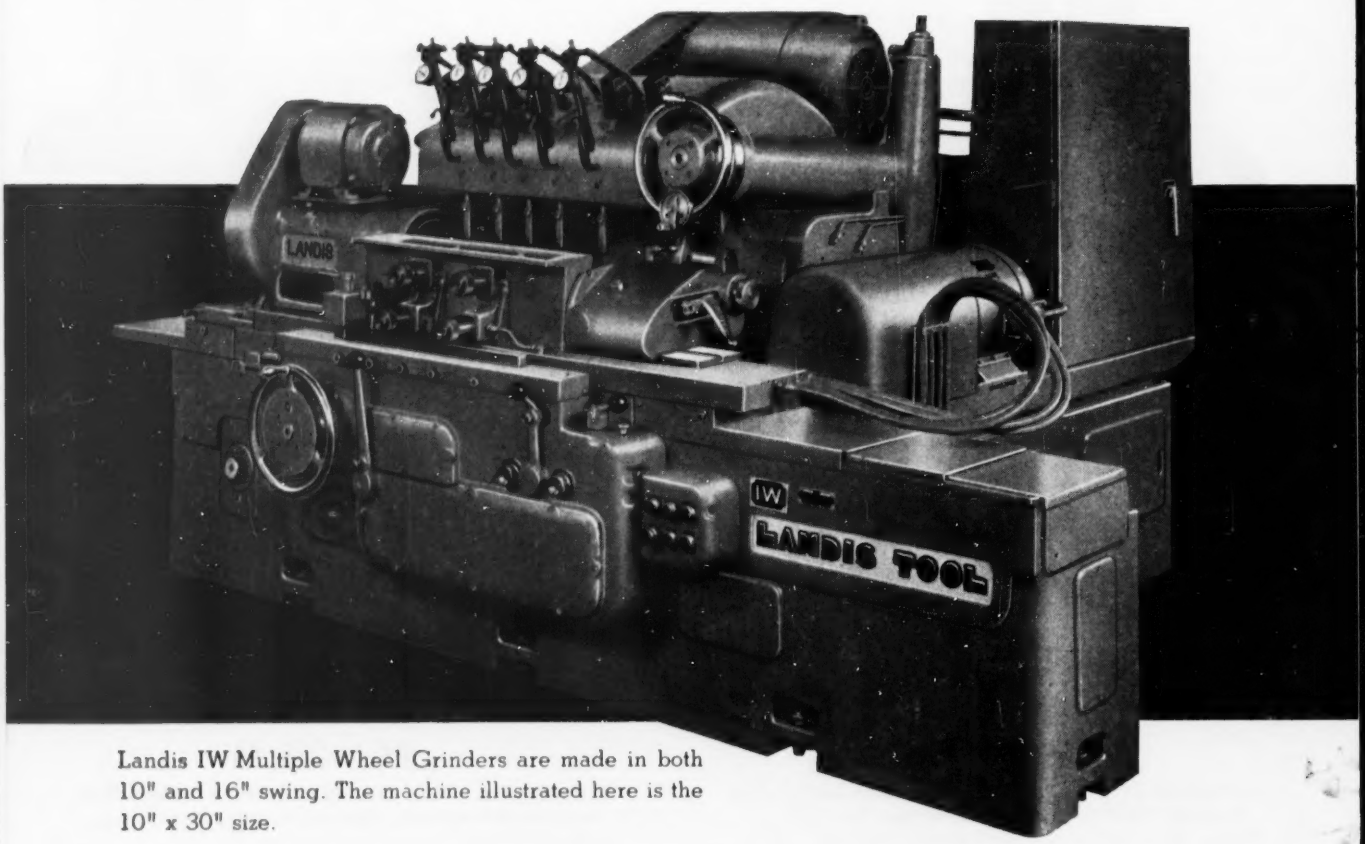
How Landis Multiple Wheel Grinders Reduce Precision Grinding Costs

Less Investment — One IW replaces two or more conventional cylindrical types.

Less Grinding Time — Any number of different concentric diameters ground in one operation with semi-automatic cycle.

Less Setup Time — A single setup on the IW instead of two or more setups on the machines which the IW replaces.

Less Work Handling — Only one loading and unloading operation. No moving work from one machine to another.



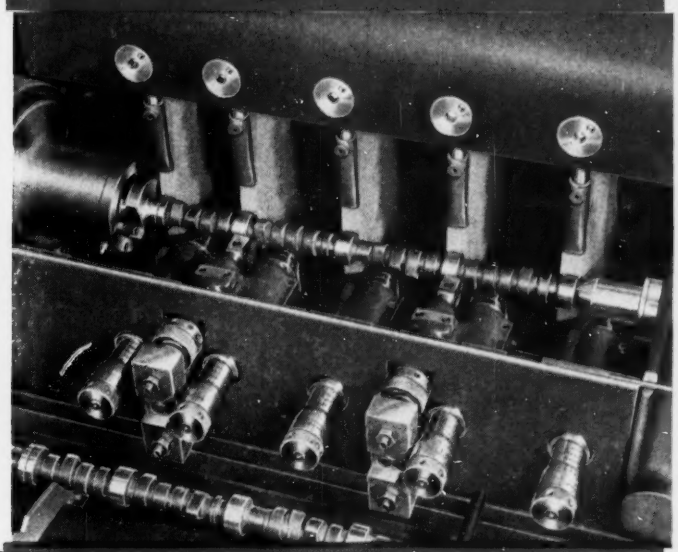
Landis IW Multiple Wheel Grinders are made in both 10" and 16" swing. The machine illustrated here is the 10" x 30" size.

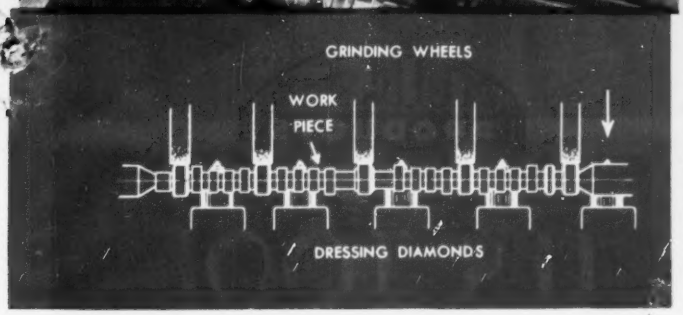
LANDIS
precision grinders

Grinding Operations

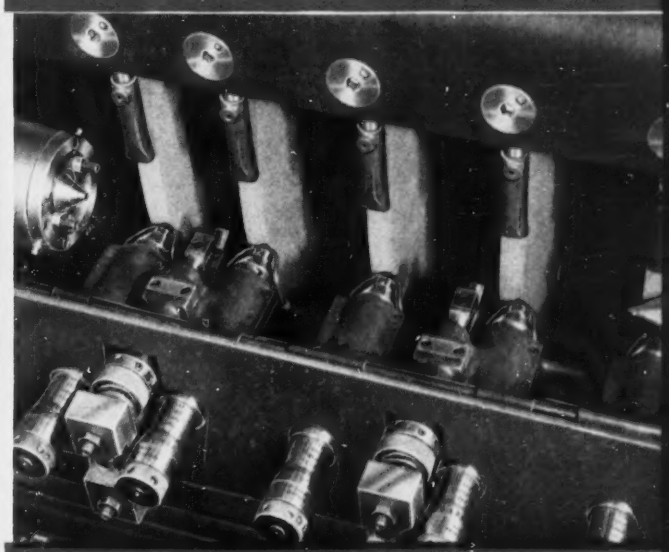
Grinds Five Diameters Concentric In One Operation

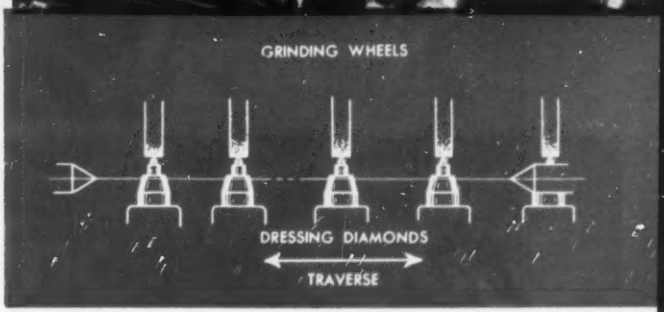
This is the finish grinding operation on the 5 line bearings of a V-8 camshaft. Stock removal is .009" to .010" and production is 60 shafts per hour. All bearings are finished in one operation.



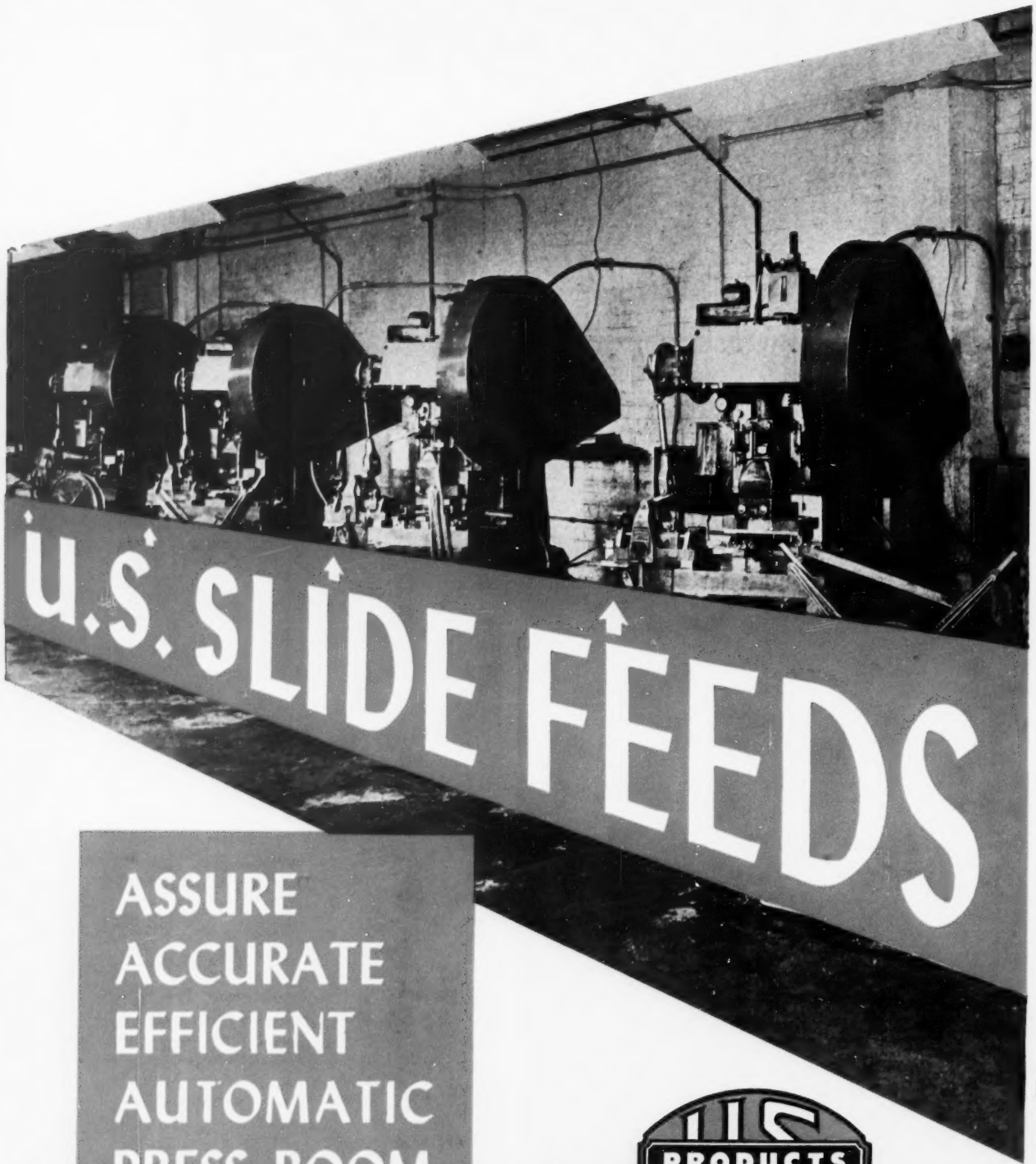


Unique method of dressing straight wheels. Saves time and insures accuracy with individually adjustable diamond positioning. Double jet cooling on each diamond. Dresser always in position.





LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U.S.A.

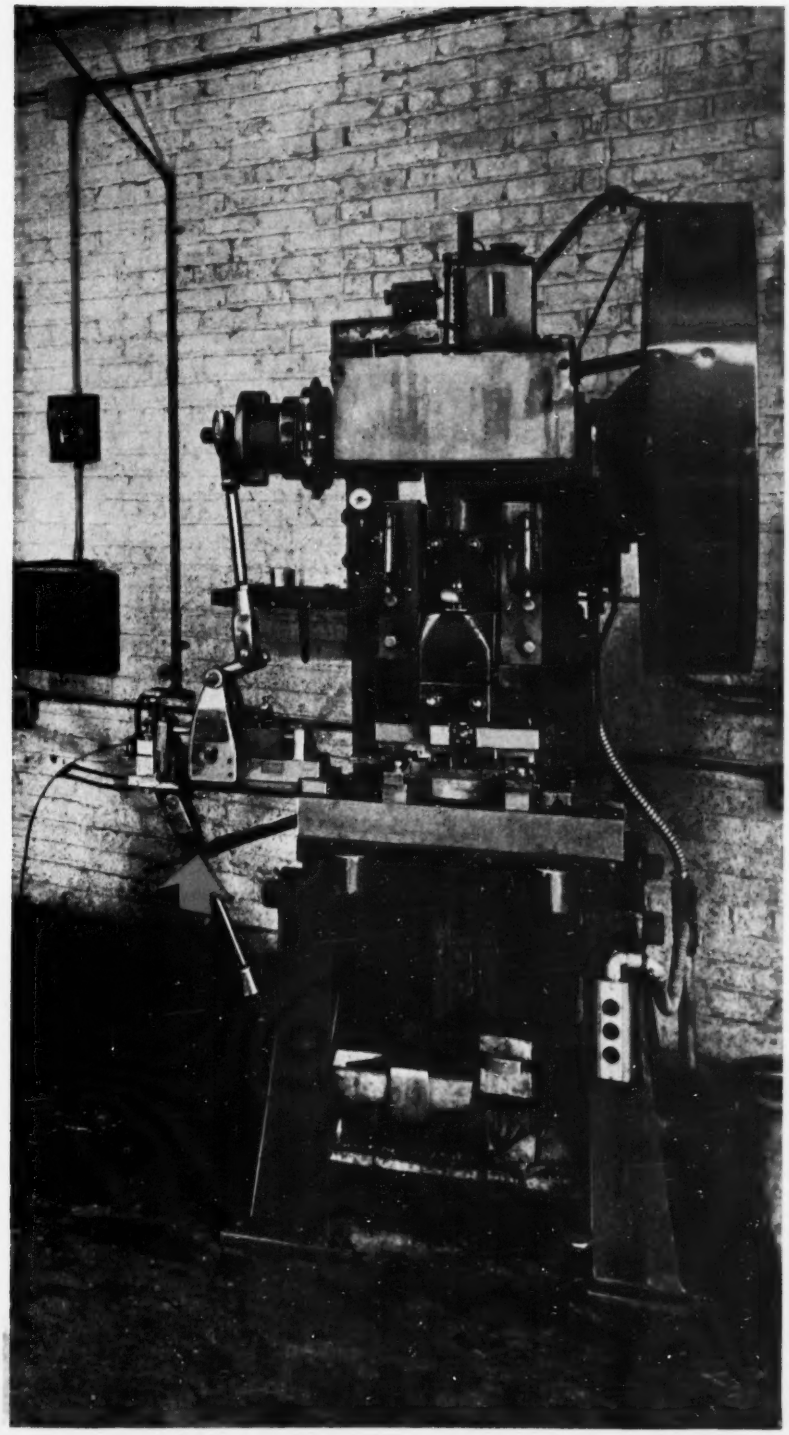


U.S. SLIDE FEEDS

ASSURE
ACCURATE
EFFICIENT
AUTOMATIC
PRESS ROOM
OPERATIONS

U.S. PRODUCTS

U.S. TOOL



THIS photograph shows a battery of presses, all equipped with U. S. Slide Feeds, at Alcon Metal Products Company in Chicago, Illinois. As with other users of U. S. Slide Feeds, Alcon Metal Products Company is gaining the advantages of automatic operation plus controlled accuracy.

When using U. S. Slide Feeds, the press is converted into an automatic machine. All the operator has to do is to load coils of material on a Stock Reel or Cradle.

Besides allowing for automatic operation, the U. S. Slide Feed is generally recognized as the most accurate Feed on the market for feeding the material into presses. The slide block which contains the blade to grip the material reciprocates on hardened and ground slide rods between definite stops. Further, the U. S. Slide Feed can pull material within its capacity through a plain Straightener and still maintain controlled accuracy.

If your production program involves press operations requiring accurate feeding of material, we believe you will be interested in the advantages obtainable through the use of U. S. Slide Feeds.

Ask for a copy of Bulletin 80-M on U. S. Automatic Press Room Equipment, which includes U. S. Slide Feeds, Roll Feeds, Stock Straighteners, Stock Reels and Coils Cradles.

COMPANY, Inc. AMPERE (East Orange) NEW JERSEY

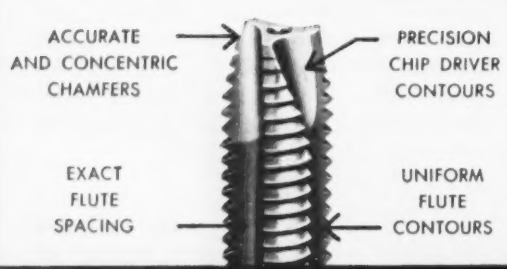
Builders of U S Multi-Slides–U S Multi-Millers

U S Automatic Press Room Equipment–U S Die Sets and Accessories

Special Application Taps from Winter

are engineered and made from start-to-finish to perform their specific work. They are *not* "altered" stock taps . . . Like all Winter products, these Special Application Taps have

BALANCED Action



WINTER TAPS FOR SPECIAL APPLICATIONS include such items as: Spiral Fluted Taps, Fluteless Chip Driver Taps, and various tap designs for special materials.

ALWAYS AT YOUR SERVICE
There's an industrial supply distributor near you who stocks a complete line of WINTER Balanced Action Taps.

WINTER BROTHERS COMPANY
Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York, Detroit, Chicago, Dallas, San Francisco.
Division of National Twist Drill & Tool Co.

WINTER

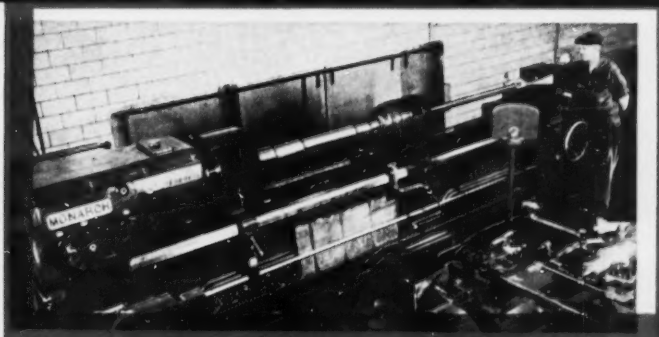
To Make Long Holes Straight and True

When you have a part that calls for straight-and-true holes, National's TARGET* and CENTERCUT GUN DRILLS will give you alignment and finish. In many cases, these tools are producing the holes as specified with no further finishing, in a single operation.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Factory Branches: New York • Detroit • Chicago Dallas • San Francisco

*Patented



Producing straight-and-true holes in Monarch Lathe Spindles, with National Target Gun Drills.

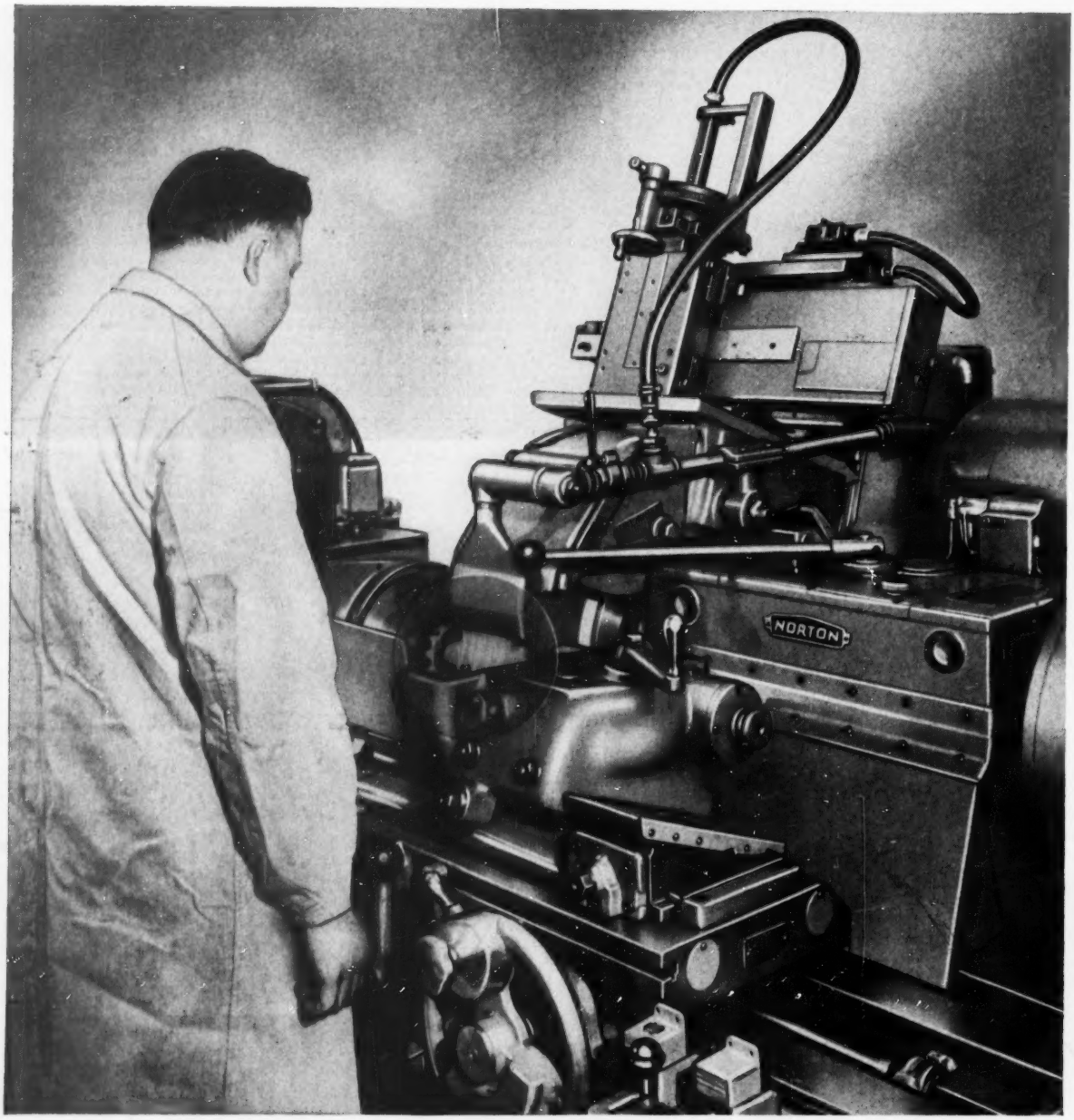
ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR about National's new concept of straight-and-true deep hole drilling—or send specifications of your work to National in Rochester.

NATIONAL TWIST DRILL & TOOL CO. ROCHESTER, MICH., U.S.A.

National

Here's your

"TOUCH



HE HAS THE "TOUCH OF GOLD." He is operating a Norton 10" Type CTU-HD semiautomatic grinding machine which frees him almost entirely for loading and unloading the work of one or more machines. This machine has automatic feeding and control, it has high output and great versatility. The operator can reach all controls from one position.

OF GOLD"

for heavy-duty cylindrical grinding

Norton 10" Type CTU-HD brings new production speed to wide wheel plunge grinding jobs

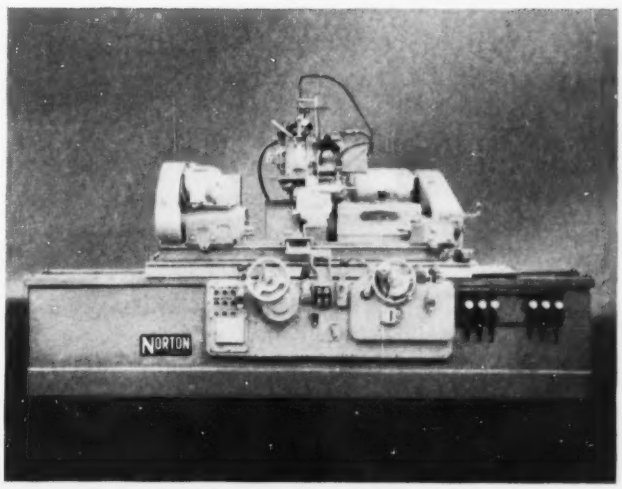
This is heavy duty cylindrical grinding at its modern best. This new 10" CTU-HD grinding machine adds value and usefulness to every piece of work it grinds. It gives you the "Touch of Gold" by increasing production rate and profit margin, too.

Norton 10" Type CTU-HD (and its companion 14" Type LCTU-HD for increased swing) employ very wide wheels or multiple wheels widely spaced for plunge cut operations. For such work as grinding crankshaft bearings, wheels of large diameter permit a maximum amount of wheel wear before interference with parts of the work.

In addition to the larger wheel capacity, these machines incorporate the many time-tested features of Norton standard Type CTU grinding machines . . . simplified operation . . . simplified maintenance . . . automatic or manual control of work rotation and coolant flow. They are built for work lengths between 18" and 72".

Reliable, rugged qualities are built-in. Wheel feed is by a precise revolving feed screw mechanism having the sensitive touch click-count index, by which settings for .0001"—in work diameter reduction are made instantly and without need for visual check.

More detailed information is given in Norton Supplement 807 and Catalog No. 1787-2. Only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. Take advantage of this experience — discuss your present grinding problems or your post-emergency production. Write NORTON COMPANY, Machine Division, Worcester 6, Mass.



LOOKING AT THE MOST MODERN grinding machine of its type. A single operating lever puts the grinding cycle control within operator's easy reach at a convenient height. Special job-easing equipment such as the Automatic Wheel Guard Type Truing Device, the Endwise Work Locator, and the multi-diameter set of grinding gages as shown, is available as extra.

***To Economize, Modernize With* NEW**

NORTON

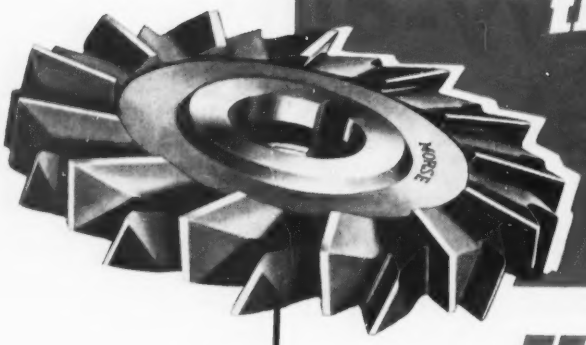
GRINDERS *and* LAPPERS

Making better products to make other products better

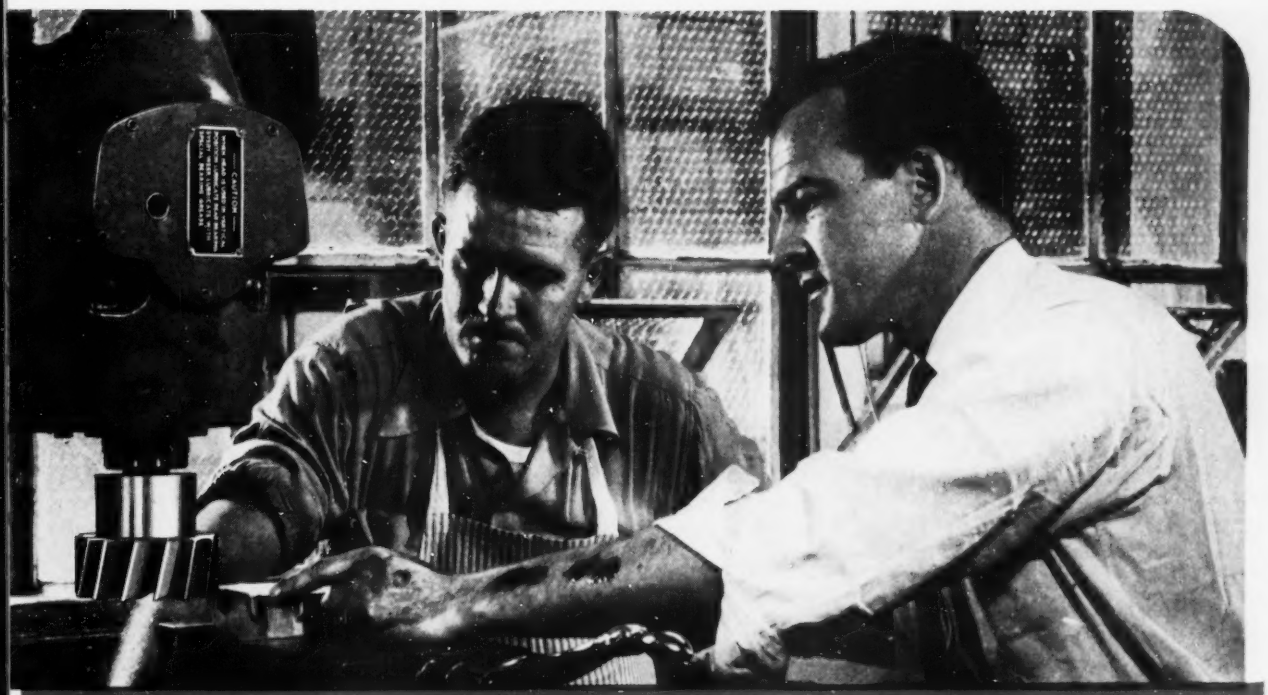
District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5

For more information on products advertised, use Inquiry Card, page 261

He never cares how black his white collar gets—when there's a job to be done for you!



...Your Morse-



Franchised Distributor

He's an everyday working man, your Morse-Franchised Distributor. He pitches in with your own men, right up to the elbows, when there's a cutting tool problem to be licked. Remember he has the hard-earned experience to do it . . . backed by the tool industry's finest engineering staff and the confidence that comes of his knowledge that back of him is a *complete line of the world's finest cutting tools.*

So when you are faced with a tough problem involving cutting tools, send for your Morse-Franchised Distributor. He'll take it off your hands, and clean it up fast and right! *Call him today.*

MORSE TWIST DRILL & MACHINE COMPANY, NEW BEDFORD, MASSACHUSETTS

(Division of VAN NORMAN CO.) • Warehouses in New York, Chicago, Detroit, Houston, San Francisco

MORSE

Cutting Tools

Buy them by phone from your Morse-Franchised Distributor and save ordering time

For more information on products advertised, use Inquiry Card, page 261

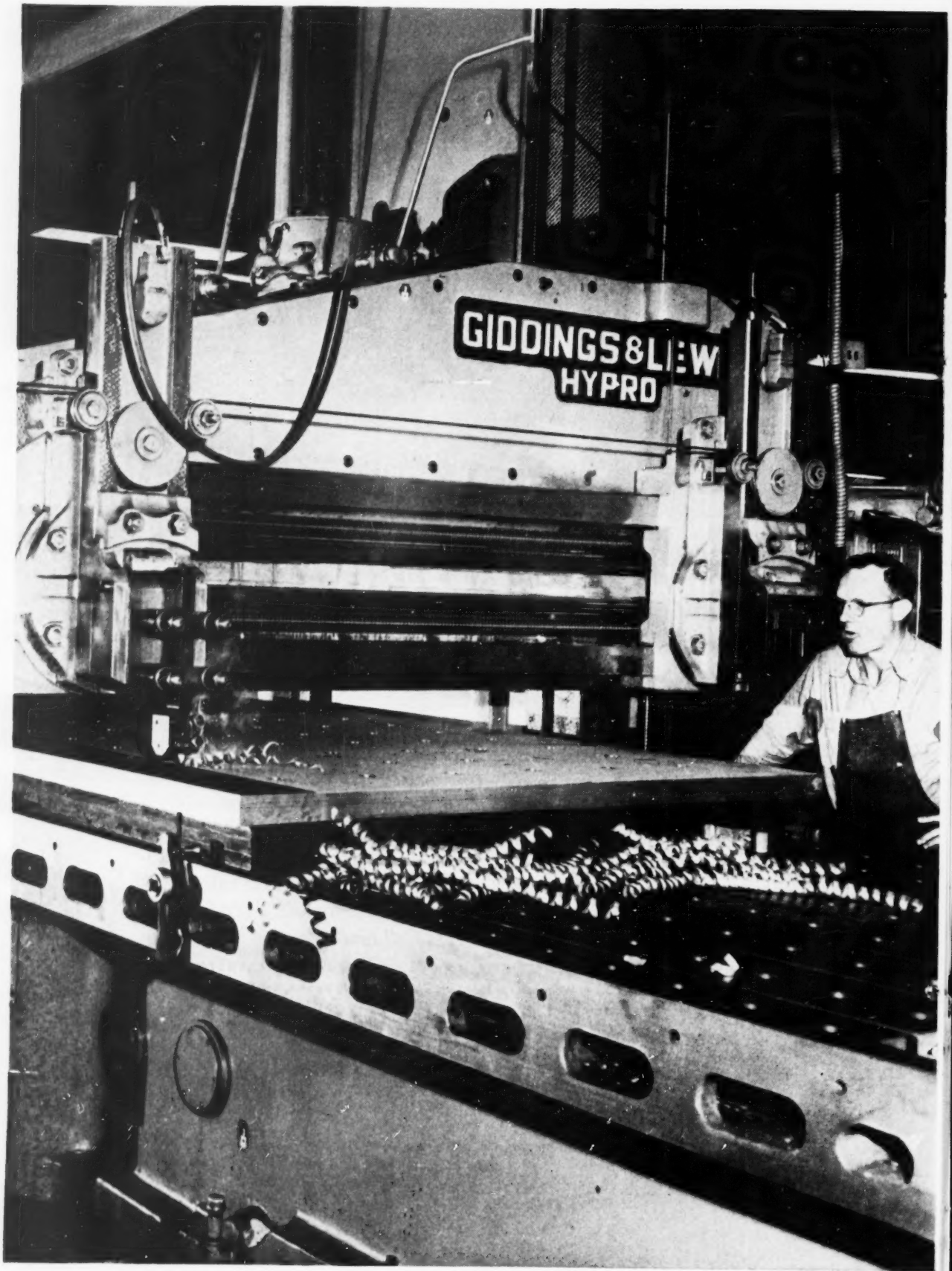

GIDDINGS & LEW
HYPRO

Photo courtesy of
TEMCO Aircraft Corporation
Dallas, Texas

Metal Surgeon...

with a flair for general practice

Performing with speed and precision this G & L Openside Planer gives you a highly versatile tool to handle both common and uncommon work with equal efficiency

Productive flexibility . . . that's one of the many big advantages of using a G&L Planer such as this Hypro Openside machine. Whether it's a simple or complex job . . . long or short run . . . big or small workpiece — this versatile machine completes it in minimum time with a minimum of setups.

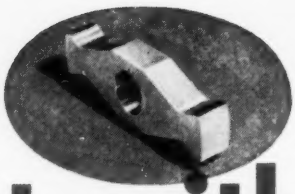
Its openside construction allows you to handle workpieces up to 120 inches in width. Table lengths can be furnished in the proper size you need, and horsepowers range up to 100. Smooth, responsive control minimizes tool breakage, and outstanding rigidity allows holding tolerances within ten-thousandths.

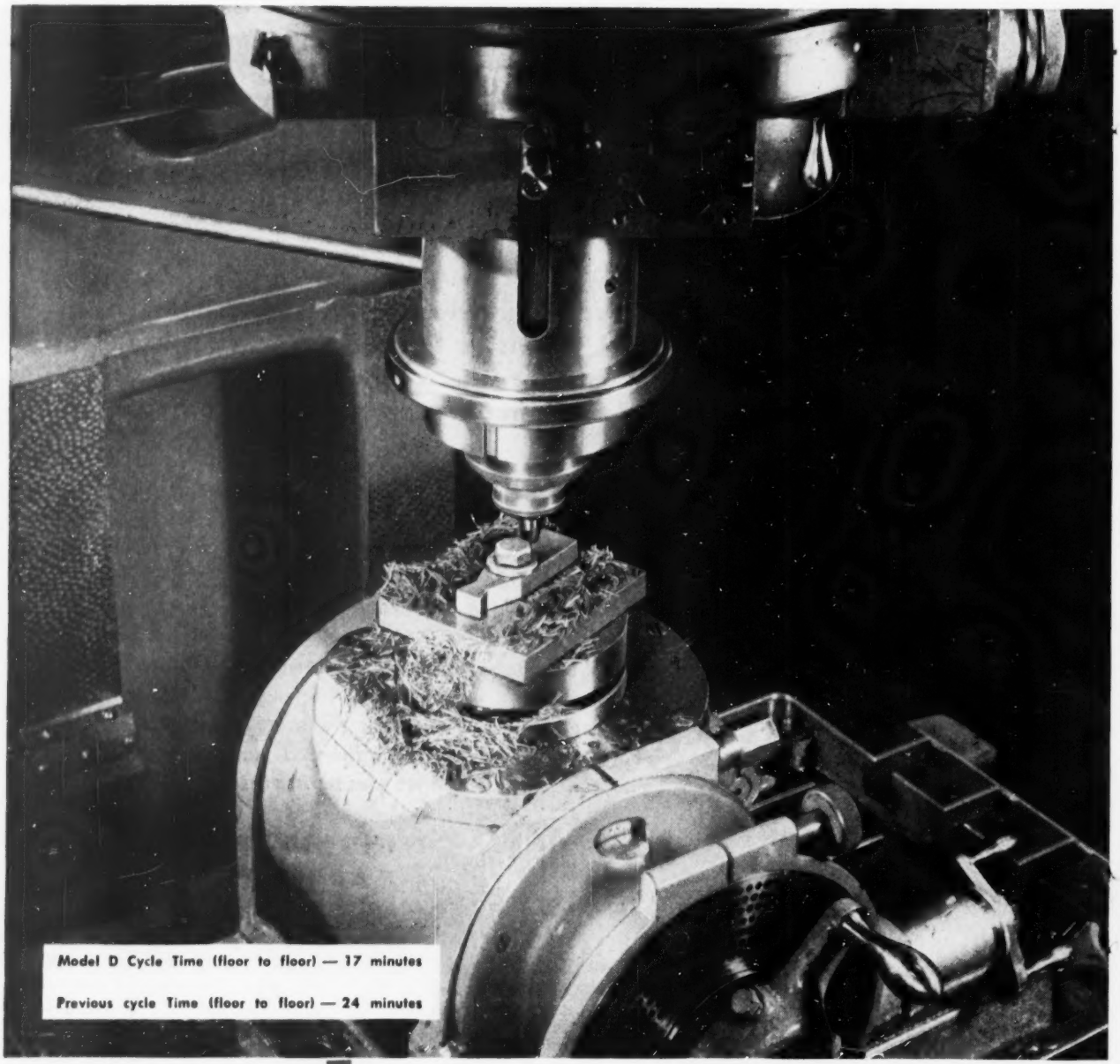
For complete information on the G&L line of Openside or Double Housing Planers, see your representative or write —

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools—Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

This part  is the blueprint, with a



PRODUCTION DATA

Part	Control Valve Lever	**Spindle Speed**	530 rpm
Material	SAE 1020	**Lot Size**	50 pieces
Cutter	½ in. — 2-lip HSS End Mill	**Machine**	Model D

finish-milled direct from single setup, in 17 min.!

Kearney & Trecker Model 2D Rotary Head Milling Machine saves six hours on 50 piece run

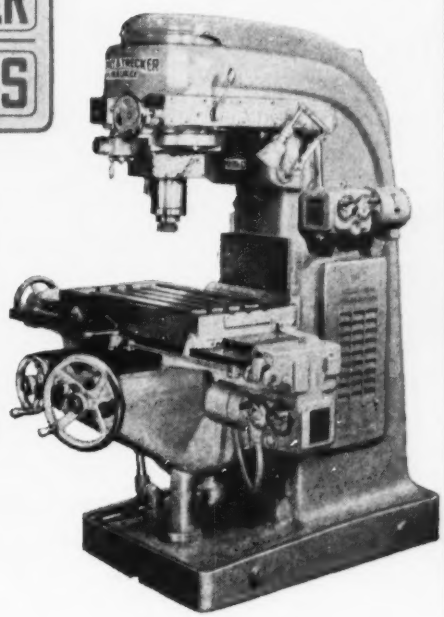
HERE is another example of the tremendous time and tooling savings possible with the rotary head milling method.

This manufacturer used to complete a control lever every 24 minutes. Now the same work is completed in only 17 minutes. . . . and no multiple setups or expensive form cutters are necessary. The blueprint is the only guide the operator needs — the machine's precise mechanical control of the cutter's angular and radial movements does the rest.

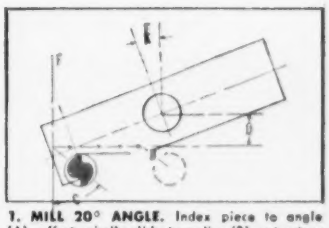
Here's the Rotary Head Milling Machine Production Idea Booklet. It contains several examples of how this method has been found exceptionally efficient in solving production, die, forging and metal pattern milling problems. It's yours for the asking.

Address requests to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

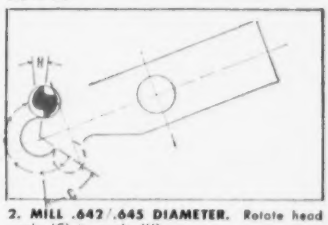
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS



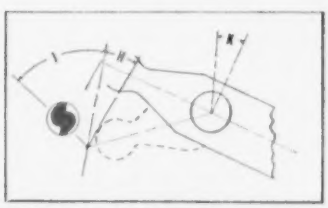
THIS IS THE MACHINE that will handle your light production milling faster, easier and at tremendous savings over any other method. If you have any production problems in plastic molds, die-casting, forging and stamping dies, or selected production milling operations — it will pay you to investigate the Model 2D Rotary Head Milling Machine.



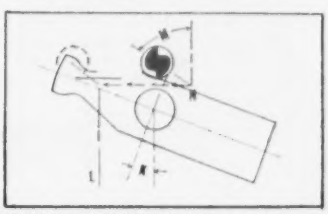
1. MILL 20° ANGLE. Index piece to angle (A), offset spindle slide to radius (B), set rotary head to angle (C), saddle to (D). Feed table (E) to (F).



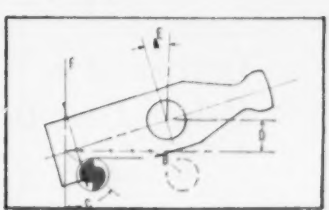
2. MILL .642/.645 DIAMETER. Rotate head angle (C) to angle (H).



3. MILL 1⅛ IN. RADIUS. Rotate head from angle (H) to angle (J), index dividing head from angle (A) (Oper. 1) to angle (K).



4. MILL 20° ANGLE. With piece at (K), move center of head to (L); rotate head to (M). Feed table (L) to (N).



5. MILL SAME FORM ON OPPOSITE END. Repeat operations 1 through 4 by indexing the workpiece to angle (A-Oper. 1).

There's a *simple* way to solve what appears to be a complex speed reduction problem

Get the proper drive combination that best meets your requirements from the broad LINK-BELT line

YOU'LL find your power transmission costs are lowered several ways when you use Link-Belt enclosed gear drives. First, Link-Belt offers a broad range of types and sizes in helical, herringbone and worm gear designs. You get the *one* reducer best suited to your needs.

In addition, Link-Belt builds a complete line of power transmission machinery. Installation and alignment are simplified because dimensions of Link-Belt chains and sprockets, bearings and couplings are all coordinated. And there's no need to call in another firm for any information or assistance.

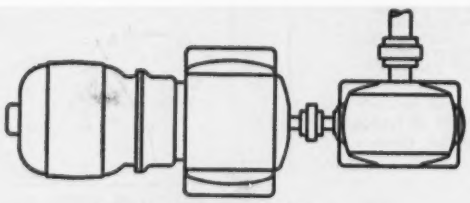
This overall integration—plus the long life built into every piece of Link-Belt equipment—guarantees optimum efficiency. Result: lower power consumption and maintenance costs.

Make the nearby Link-Belt sales office or distributor your power transmission headquarters. Nowhere else can you get the great selectivity that assures you of the best in enclosed gear drive applications.

LINK-BELT

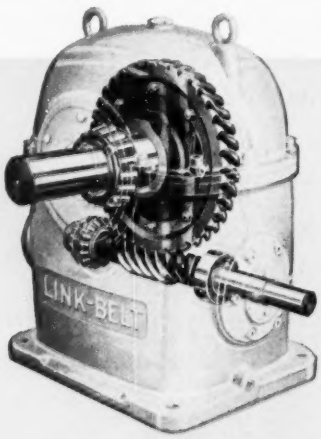
ENCLOSED GEAR DRIVES 13.127

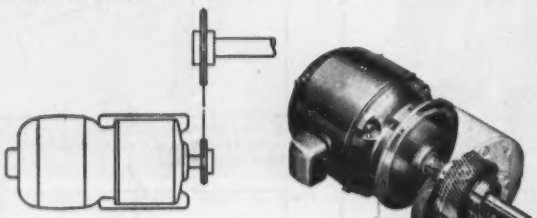
LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities.



Worm Gear Drive

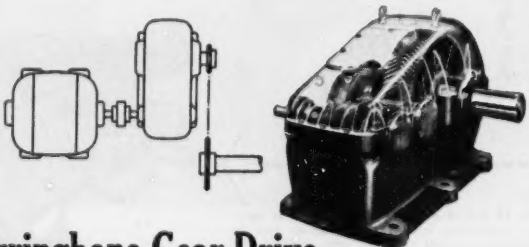
WORM GEAR and P.I.V. variable speed drives are shown direct-coupled. Link-Belt worm gear drives are available in 3.1:1 to 8000:1 reduction ratios—1400 to 123,000 in. lbs. torque—0.22 to 564 output shaft rpm. Ask for Book 2324A.





Gearmotor & Helical Gear Drive

GEARMOTOR is shown with roller chain drive. Link-Belt Helical Gear Drives, Gearmotors and Motogears are available in 6.2:1 to 292:1 reduction ratios—1 to 30 hp—6 to 280 output shaft rpm. Ask for Books 2247 and 2451.



Herringbone Gear Drive

HERRINGBONE GEAR DRIVE is shown connected by flexible coupling to motor and with roller chain takeoff. Link-Belt Herringbone Gear Drives are available in 2.84:1 to 326:1 ratios—0.4 to 2480 hp—2.2 to 623 output shaft rpm. Ask for Book 2519.

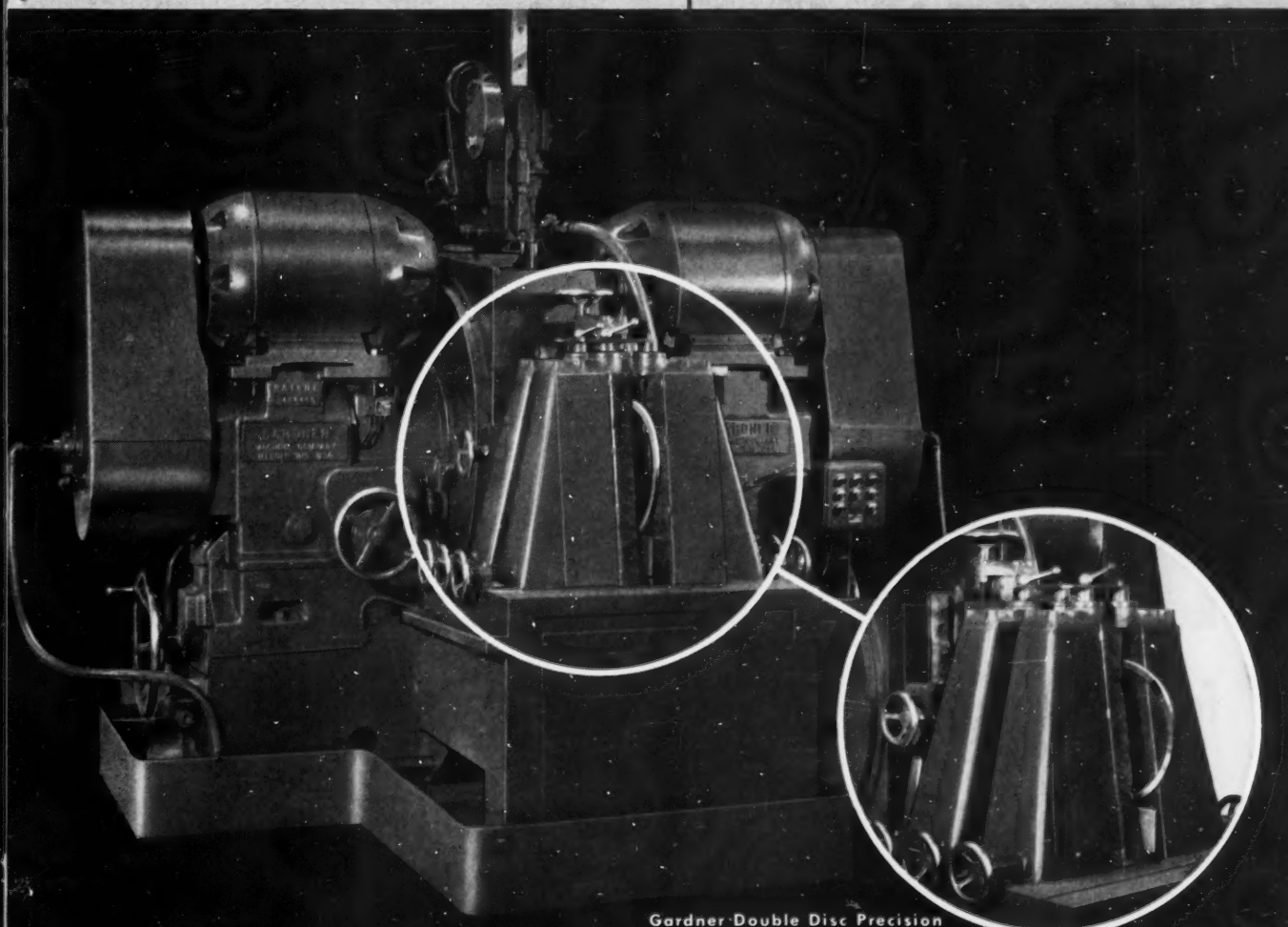
For more information on products advertised, use Inquiry Card, page 261

Grinding Time Reduced 50% By Change to Gardner Method

Replaces one side at a time process

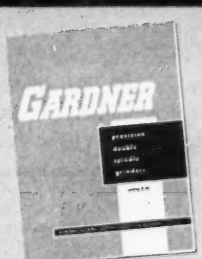
Unit costs reduced by grinding TWO parallel surfaces in ONE operation

Automotive flywheel ring gears of 15.049" O.D. x 14.216" I.D. x .568" thick are ground from rough steel forgings. .036" overall stock removed in 4 passes at rate of 135 finished pieces per hour. Tolerances: .001" to .002" for parallelism, .005" for uniformity.



Gardner Double Disc Precision Grinder No. 848-42" with feed-thru fixture with power operated rolls front and back.

125M

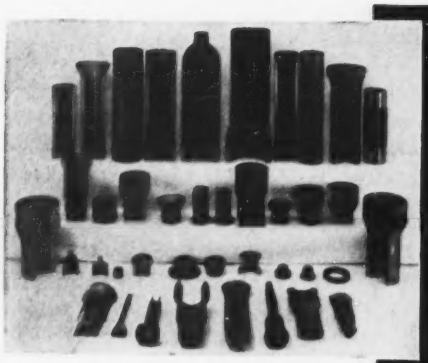


Request Catalog D-53.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U. S. A.

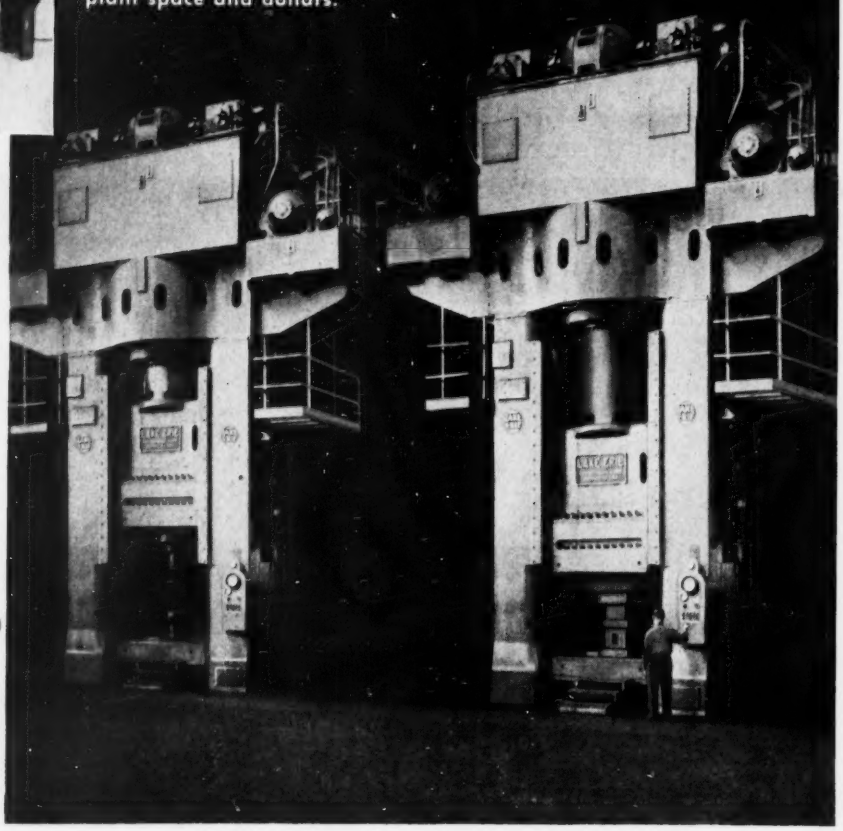
GARDNER

precision disc **Grinders**



● Typical parts produced by Mullins Steel Koldflo* Process with a definite savings in steel, manpower, machine tools, plant space and dollars.

WORLD'S FIRST COMMERCIAL FACILITY



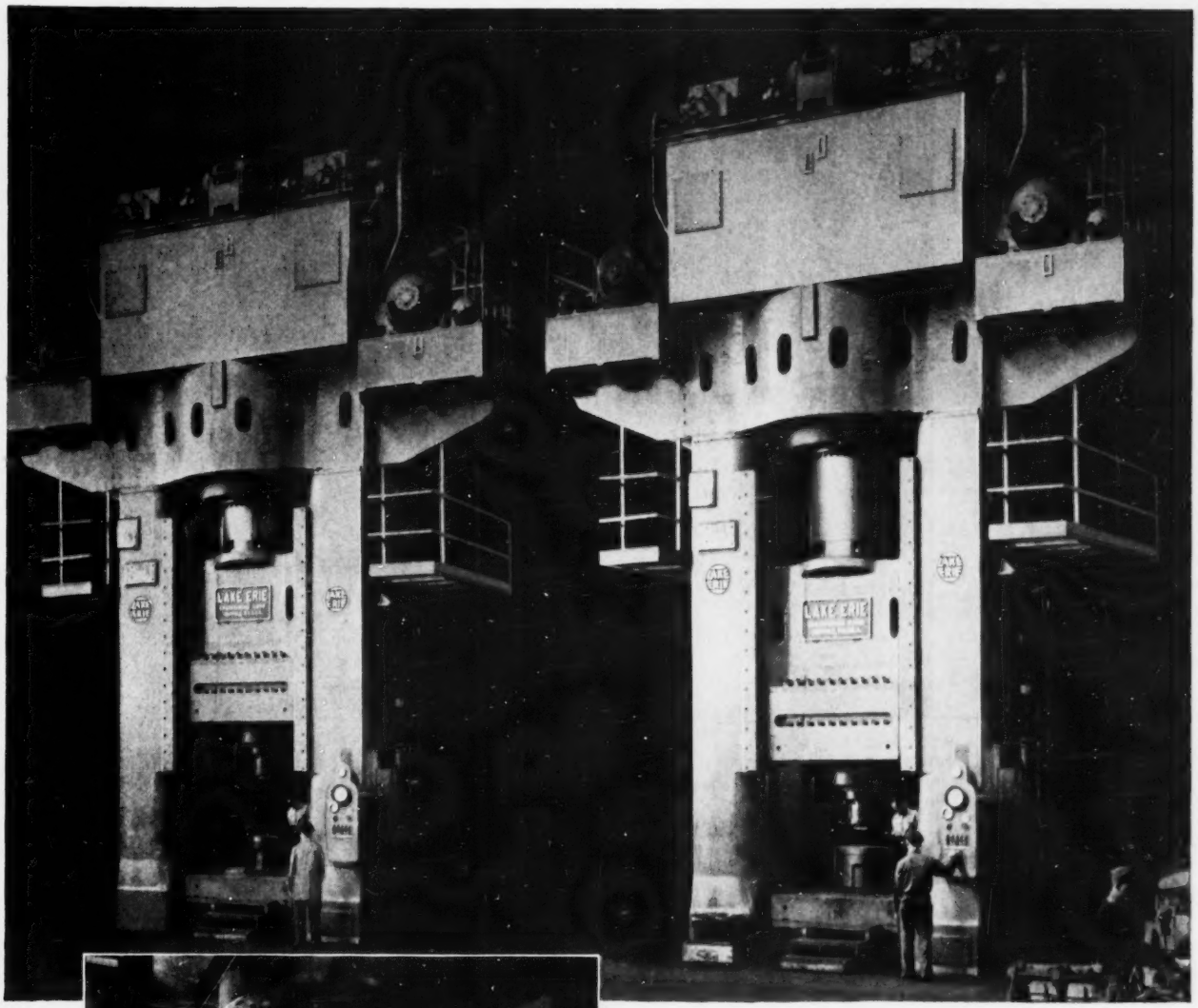
for producing parts by MULLINS STEEL Koldflo* Process

This new facility of the Mullins Manufacturing Corporation makes available to American Industry for the first time the economies and other advantages of Koldflo* production. It is a process in which parts are cold-formed into hollow shapes with a wide variety of configurations and in lengths from 6″ to 36″ with diameters from 2″ to 6″. The finished products come from the presses with smoothness, hardness, strength and precision. All of these desirable features are obtained by this process while using low carbon, low cost steel.

MAIN BATTERY OF PRESSES FURNISHED BY LAKE ERIE

These four 3,000-ton hydraulic presses weigh over 700,000 pounds each. They stand 33′-3″ above the floor and extend 6′-7″ below the floor. Beds measure 72″ x 60″, daylight openings are 96″ and strokes 48″. The high-speed, self-contained pumping units on each press are powered by 750 HP motors. This installation is another excellent example of Lake Erie's ability to construct hydraulic presses for any process or manufacturing requirement.

*Koldflo is a trade-mark of Mullins Manufacturing Corporation.



FIRST PRESS PRODUCED IN THE UNITED STATES SPECIFICALLY FOR THE COLD EXTRUSION OF STEEL

Close-up view of the original 3,000-ton Lake Erie "laboratory" press purchased by Mullins in 1949 for Koldflo* development and production. Outstanding performance of this press led to the selection of Lake Erie equipment again for the main battery in Mullins' new commercial installation. There can be no better evidence than this of customer confidence and satisfaction.

LAKE ERIE
HYDRAULIC PRESSES

LAKE ERIE ENGINEERING CORP.

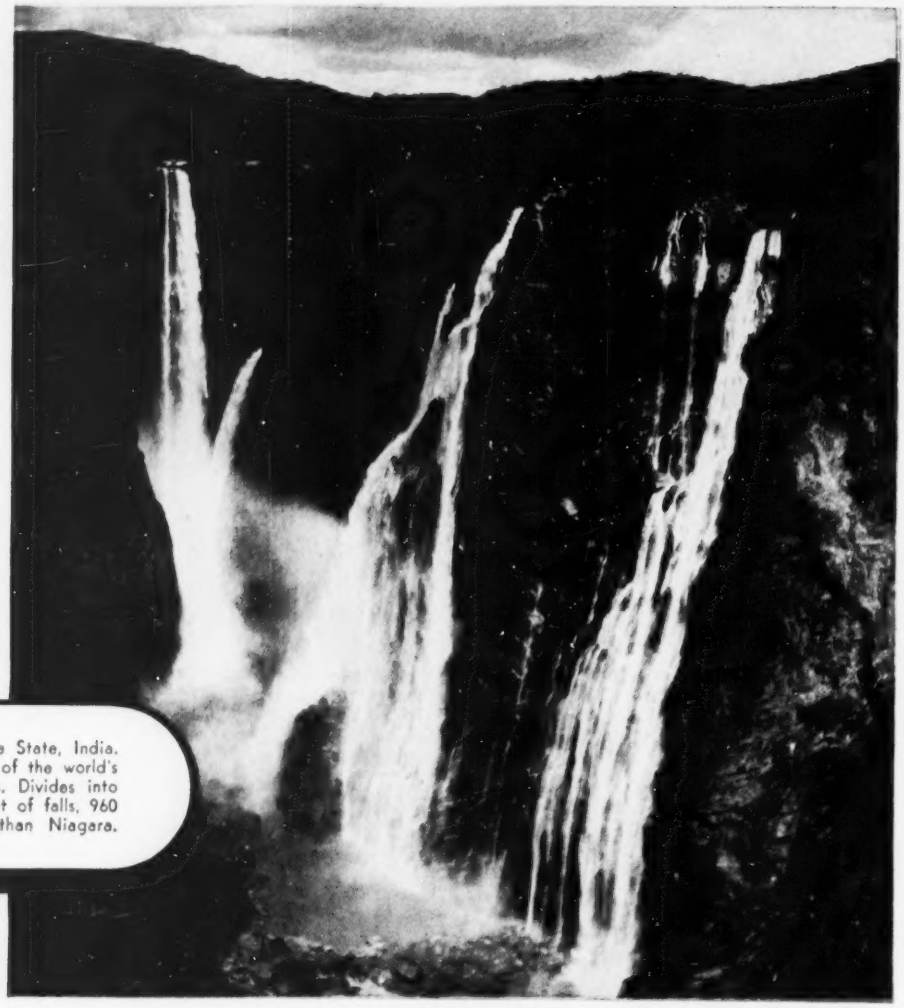
General Offices and Plant
170 Woodward Avenue, Buffalo 17, New York
District Offices in NEW YORK • CHICAGO • DETROIT • PITTSBURGH
Representatives in Other U. S. Cities and Foreign Countries
Manufactured in Canada by: CANADA IRON FOUNDRIES LIMITED

HYDRAULIC PRESSES • DIE CASTING MACHINES
ROLLING MILL AUXILIARY EQUIPMENT

LAKE ERIE ®

For more information on products advertised, use Inquiry Card, page 261

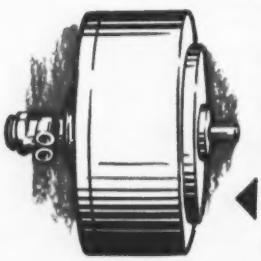
LOGAN FLUID POWER • DURABLE, DEPENDABLE SINCE 1916



Gersoppa Falls in Mysore State, India. India's greatest and one of the world's most spectacular wonders. Divides into four separate falls. Height of falls, 960 feet, five times higher than Niagara.

LOGAN *ROTATING AND NONROTATING* AIR CYLINDERS

FAST-ACTING, POSITIVE CONTROLLED POWER . . . AT LOW COST



Rotating Air Cylinder

NONROTATING—7 STANDARD MOUNTING TYPES

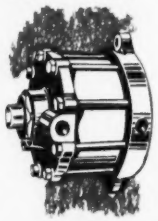
Standard sizes from 1½" to 16" bore; maximum stroke, 18 feet. Special models to meet your requirements.

Logan Features—Larger Ports . . . More Sturdy Construction . . . Maximum Power Without Leakage . . . Permanent Seal Around Piston Rod . . . Standard Models With or Without Cushioning.

ROTATING

Two Standard Styles—Type R with cast iron body; Type K with lightweight aluminum body.

Bore diameter 1½" to 20"; piston stroke 1" to 2"; longer strokes available as special. American Standard adaptations.



Nonrotating Double-Acting Air Cylinder

Consult Logan for your special heavy-duty, mill-type cylinder requirements

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

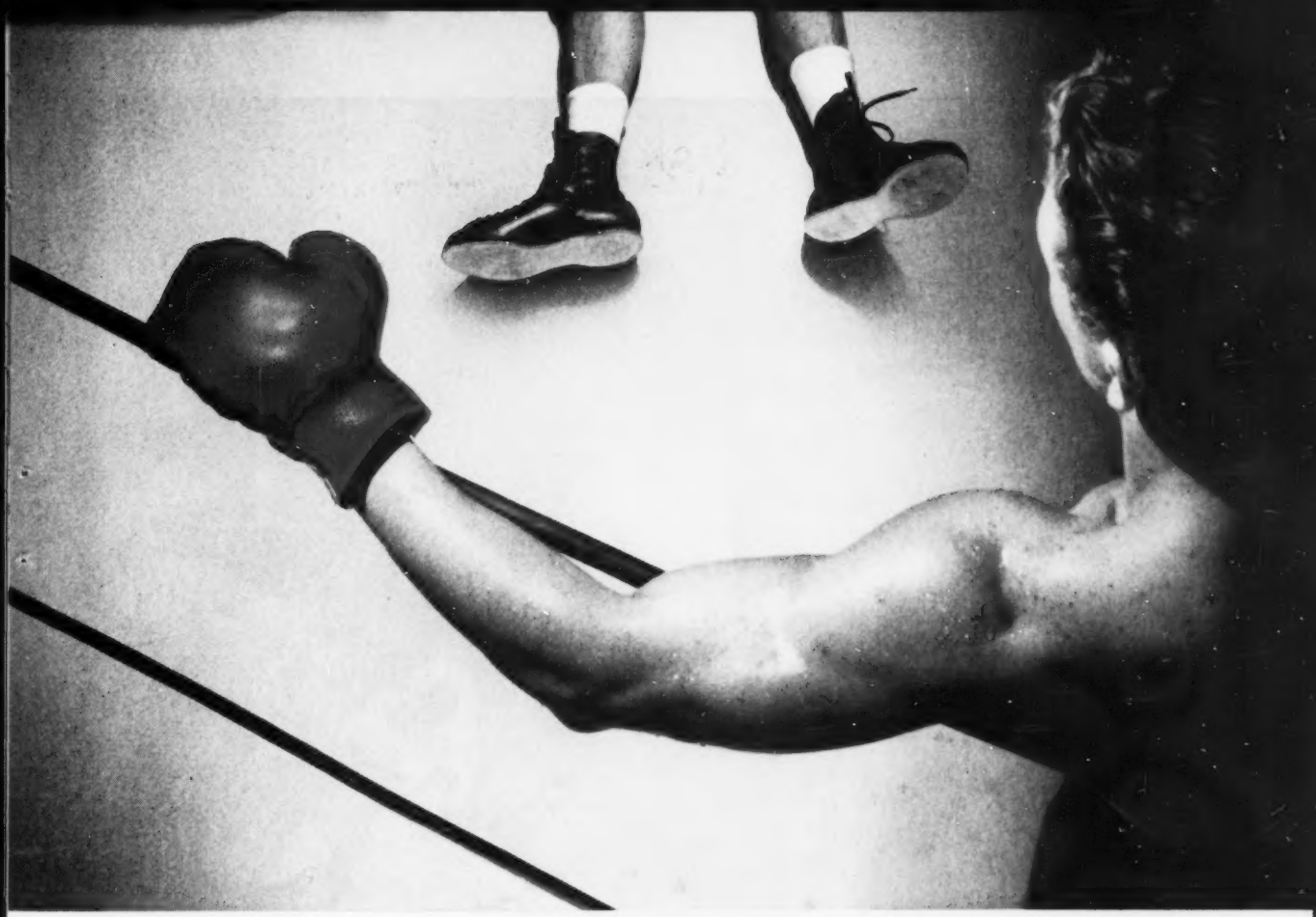
FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME Logan AIR AND HYDRAULIC EQUIPMENT EFFORT • MOTION

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.

For more information on products advertised, use Inquiry Card, page 261



How to KO high costs . . .

. . . SWITCH TO CIMCOOL®, the radically new and different cutting fluid that's hailed as one of the "finds" of the century. This revolutionary cutting fluid—this *chemical emulsion*—is always a winner, because it does a *better job* while saving money three important ways:

CIMCOOL INCREASES TOOL LIFE (and thus reduces down time) because of its chemical lubricity.

FASTER SPEEDS are possible because Cimcool cools faster, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.

CIMCOOL COSTS LESS than old-fashioned cutting fluids because it lasts longer. It also cuts labor costs for cleaning and changing. It virtually eliminates rancidity and foul odors. And because of its low surface tension and low adhesion to work and chips, there is practically no carry off.

If you'd like to see CIMCOOL's one-two-three punch for yourself, ask for a demonstration. Just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet "Cimcool Defeats Heat." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

CIMCOOL

for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

When Precision was the Pay-Off!

HALEY MACHINE COMPANY, Springfield, Ohio, recently installed a Warner & Swasey 1 AC Single Spindle Automatic Chucking Machine to turn vital, high-precision hydraulic pump parts for U. S. Army tanks. The job called for extreme accuracy, because these pumps are filled under pressure with an antifreeze that has a tendency to leak where water will not.

To avoid leakage these extremely close tolerances had to be held—40 to 63 micro-inch finish on surface finishes, .002″ on forming, .0008″ to .001″ on turning, and .001″ in concentricity. Maintaining such accuracy with previous methods was difficult—scrap loss was too high. Production had to be speeded up.

The Warner & Swasey Automatic took the function of holding these close tolerances out of the operator's hands—substituting the automatic operation of this high-precision machine for the job. Production was doubled—in some cases tripled! Scrap loss was reduced 12 to 15%!

This type of consistent accuracy is just not possible by manual methods due to the human error of even the best machinists. It is even unusual for an automatic. But the Warner & Swasey 1 AC has the rigidity, the *built-in* accuracy, plus the ability to repeat accurate settings to handle the *most difficult* jobs!

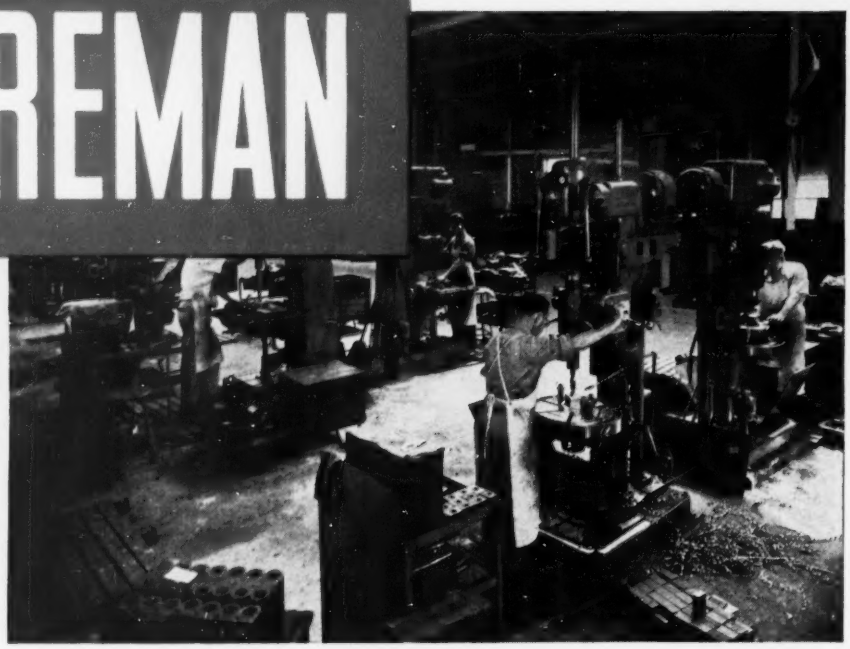
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

CLEEREMAN

DRILLING MACHINES

A battery of box column and round column Cleereman Drilling Machines on production work. One of many such installations producing at lower costs with higher production, less operator fatigue and no down time.

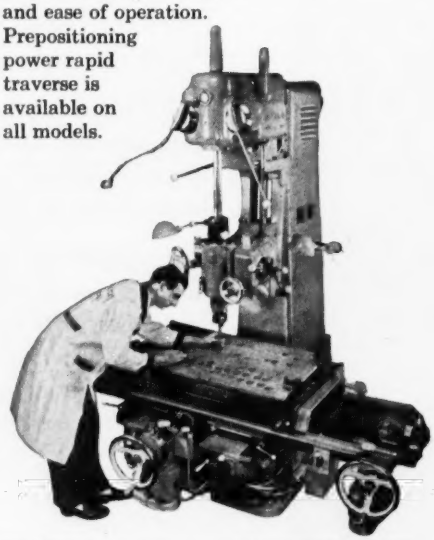


LAYOUT DRILLING MACHINE

A modern solution to an old problem. Built for those tool room and manufacturing jobs which do not require the ultra precision of Cleereman Jig Borers. The Cleereman Layout Machine is an economical machine capable of locating within .001" per foot and drilling, boring, reaming, tapping, etc., with utmost operator ease at a fast rate of production.

JIG BORER

Unexcelled precision for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work and on "jigless" production. Combines stamina with precision and ease of operation. Prepositioning power rapid traverse is available on all models.



BRYANT Machinery & Engineering Company
General Office
640 West Washington Blvd., Chicago 6
Representatives in Principal Cities

AFFILIATED WITH

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

For more information on products advertised, use Inquiry Card, page 261

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

GETTING MORE WORK PER CHUCKING WITH C/F TURRET LATHE

Only One Tool Change Required for Variety of Sizes with Expert Setup

This producer's problem was one of *sizes.* How to get fast operation on chuck bodies in a variety of sizes with minimum possible tooling and changeover.

The solution is smart . . . and noteworthy. A Gisholt 1L Cross Feeding Saddle Type Turret Lathe was selected for the job. This was equipped with a 15" 3-jaw air chuck. This not only kept chucking time low, but also, by the use of adjustable serrated jaw bases, just one set of jaws sufficed for operation 1 to handle the numerous sizes of workpieces.

The quick indexing square turret on the cross slide has tools for turning, facing, chamfering, etc. These work simultaneously with tools from the hexagon turret, a time saver on any job.

Cross Feeding Turret Speeds Job

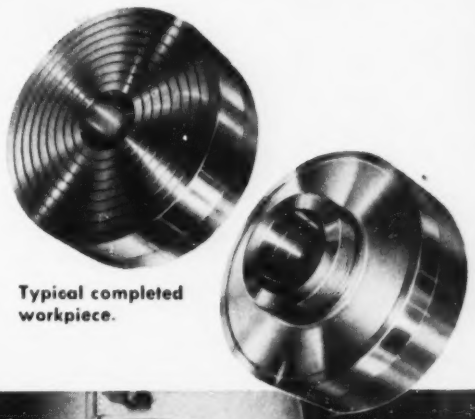
The hexagon turret is equipped with three stub boring bars for boring, counterboring, recessing or back facing. Size is set with the cross feeding turret; therefore, these same boring bars are used on many sizes of parts.

Also carried on the hexagon turret are two box-type tool posts. These are used for facing, boring or recessing. Again, because of the cross feeding hexagon turret, they are used for workpieces of various sizes.

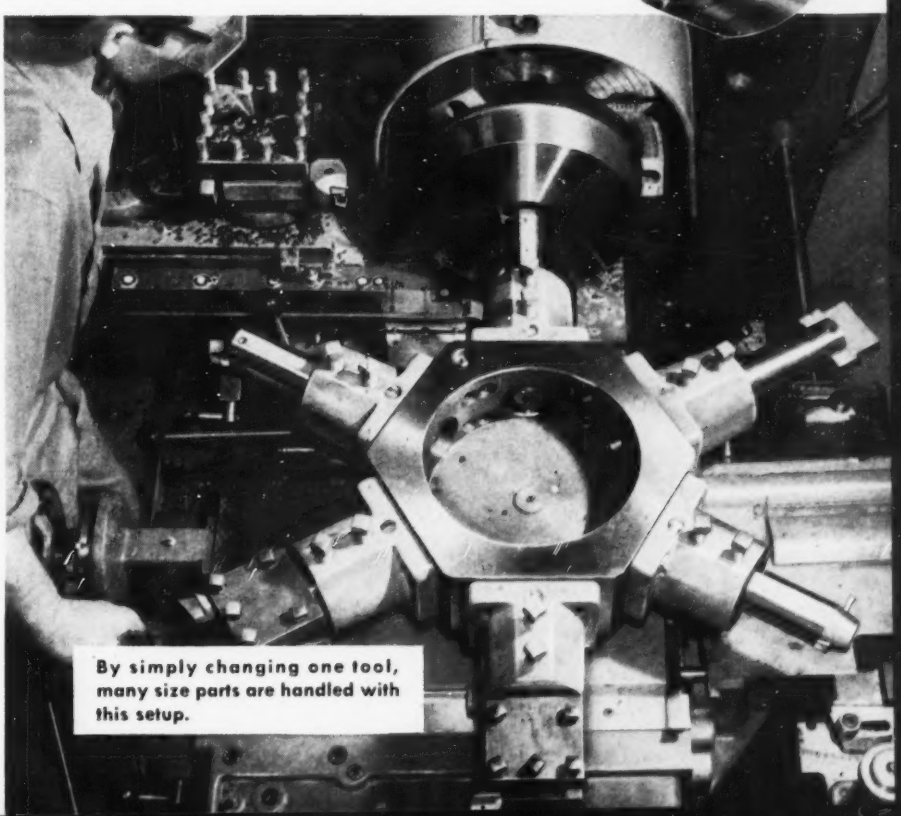
The sixth tool on the hexagon turret is a spade cutter for final sizing. This is the only tool special for each job. A quick change of this single tool readies the machine for the next job. The high production Saddle Type Turret Lathe has two additional attachments for even greater versatility. A threading attachment permits threading the hub when required. A taper attachment offers tapers up to 8 inches per foot for a wide variety of diameters.

This job shows again how you generally can do more work with fewer tools. When you specify a cross feeding turret lathe, Gisholt's 66-year experience can help you.

Simple tooling, combined with the time-saving cross feeding hexagon turret, give maximum efficiency in handling parts of various sizes.



Typical completed workpiece.



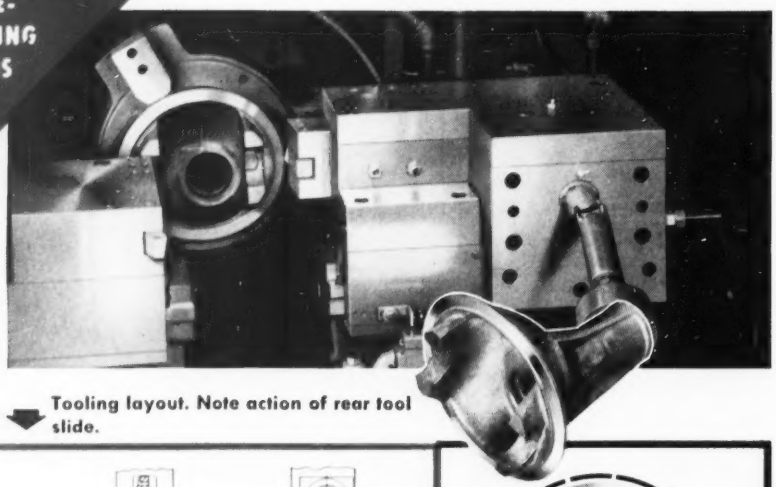
By simply changing one tool, many size parts are handled with this setup.

GISHOLT

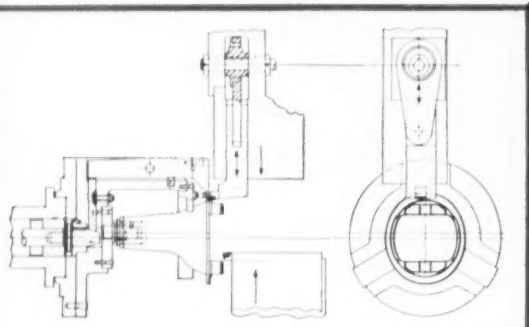
TIME-SAVING IDEAS

ELLIPTICAL MACHINING MADE EASY

Standard Simplimatics Solve Special Problem



Tooling layout. Note action of rear tool slide.



Circle indicates elliptical shape of workpiece.

An elliptical diameter was the stickler here. How to machine the oval shape . . . and do it on a standard machine and do it automatically?

The answer, this manufacturer found, was with the 3D Simplimatic Automatic Lathe. To do the elliptical pilot diameter on this differential carrier, a standard machine is used. Only a special cam-operated auxiliary tool, slide mounted on the standard rear slide, is required. This does both facing and turning and moves in and out two times each spindle revolution, generating the elliptical shape. When conventional facing and turning are called for, this slide is simply locked in position.

The standard front slide can be used for either facing or turning the bearing pads, merely by re-positioning at a 90° angle. Time for this part is 1.75 min. and one operator easily handles two identical machines for all production needed. Four different carriers are handled with simple changeover.

The simple addition of a special reciprocating tool slide equips standard Simplimatics for fast, automatic production of elliptical parts.

For complete picture reports on this and 30 other interesting jobs, write for new Simplimatic catalog.

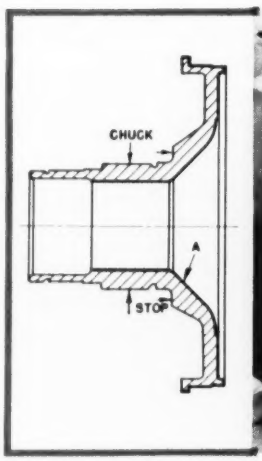
NOVEL SETUP FOR STEEP BORING

This Idea Pays Off on Ram Type Turret Lathe Job

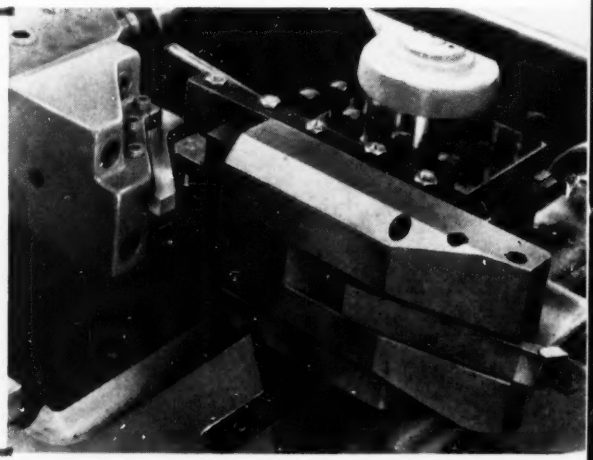
The next time you are faced with generating a steep bore similar to this, remember this production pointer.

The problem surface (see A in drawing) combines a face, radius and a 45° angular bore. Using a standard Gisholt No. 4 Ram Type Turret Lathe, a special cam is mounted on one face of the hexagon turret. On the square turret is a special spring-loaded roller slide. Here's how it's done:

Both the hexagon turret and square turret carriage are brought into position and locked. The cross slide carrying the square turret is then fed forward. As the roller on the slide tool engages the cam, the tool bit generates the interior surfaces shown. From start to finish, the job is simple. All other tooling is standard. Thus, you can handle this job—or a variety of others—quickly, economically, with very reasonable tooling costs.



The complicated interior of these rotors are generated with repetitive accuracy by the cam-guided slide tool in the square turret.



Note how sliding tool on square turret is guided by cam on hexagon turret.

GISHOLT

TIME-SAVING IDEAS

SHELL PRODUCTION...ON THE DOUBLE

No. 12 Hydraulic Lathes Enlisted for Speedy Operation

Speed was the No. 1 requirement here ... in centering and cut-off operations on 75mm. and 105mm. shells.

Here's how two different plants are pushing production using identical setups on No. 12 Hydraulic Automatic Lathes: The forgings are located from the bottom of the cavity on a mandrel and held by two sets of air-operated expanding fingers.

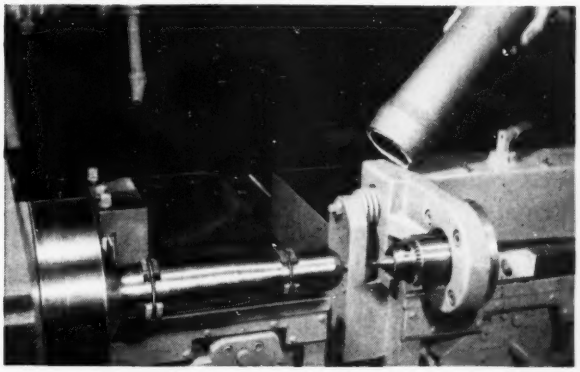
The left rear slide carries a tool block with a single tool for cut-off to length. The right slide carries an auxiliary slide on which is mounted a speeder with a center drill. The main slide moves back at the end of the cycle to clear the work for unloading.

Floor-to-floor time on the 75mm. shell (photo A) is about 0.6 minutes. Time for the 105mm. shell (photo B) is approximately 0.8 minutes. In both cases, the operators have ample time to handle two or more machines because of the automatic cycle.

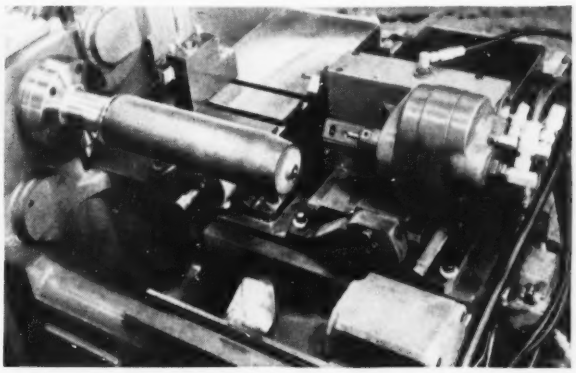
In this first machining operation, shells are faced to length . . . open end is squared . . . and proper center is established—all handled automatically, quickly and economically.

A complete catalog on the No. 12 Hydraulic Lathe is available.

(A) Close-up of No. 12 Hydraulic Automatic Lathe for work on 75mm. shell shown.



(B) Time for this 105mm. shell is 0.8 minutes.



4-MACHINE SETUP MAKES FAST WORK OF THIN-WALL PARTS

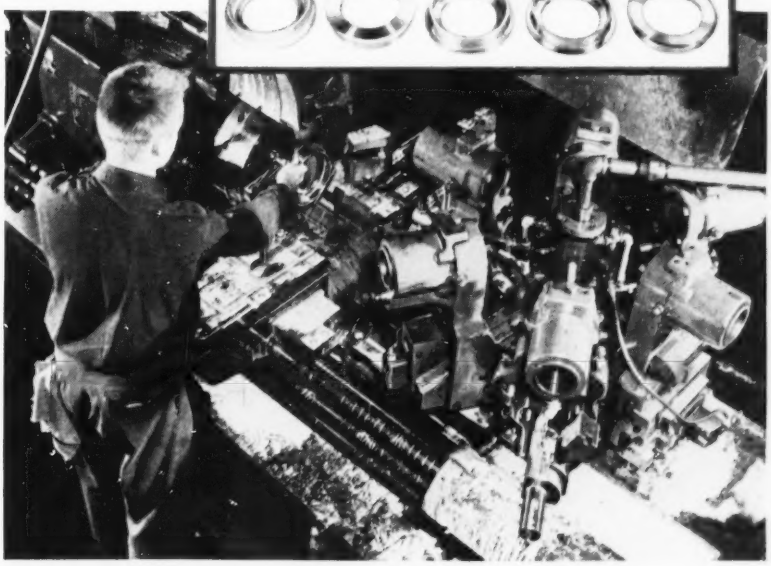
Costs are Low with one man and four Fastermatic Automatic Turret Lathes

This problem was one of accurately producing parts which require considerable stock removal, leaving them thin and frail. This precludes taking off too much metal at one time. Also, heavy chucking pressure has to be avoided to prevent distortion.

The only practical way to do it is by spreading the work over a series of relatively light cuts and doing the job automatically to keep costs low. The Fastermatic Automatic Turret Lathe, therefore, was the logical solution—with four machines handling all operations. All machines can be handled by one man since total labor time is six minutes per piece. The .004" tolerance demanded by the thin-wall section is easily met because of the Fastermatic's automatic cycle and the elimination of human error.

These thin-wall parts are accurately and economically produced by a sequence of light cuts with four Fastermatics and one man.

Rough part and after each of four operations.



Setup on one of four Fastermatics doing this job.

GISHOLT

TIME-SAVING IDEAS

HOW BALANCING PROTECTS THIS VITAL AIRCRAFT ASSEMBLY

Required Correction Shown by Direct Readings

Vibration means trouble for aircraft cabin superchargers. To insure smooth, dependable operation at high rotating speeds is this Type 13S Gisholt DYNETRIC Balancing Machine.

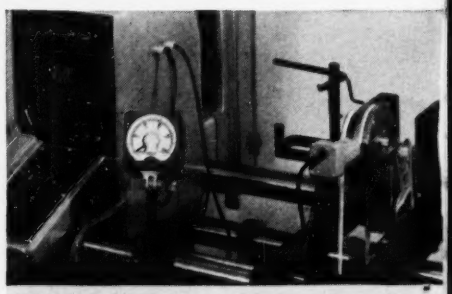
This 6-lb. assembly is supported in a cradle, rotated at 2300 r.p.m. and the amount and location of unbalance in each plane recorded. Stock is then ground off until a recheck indicates that the tolerance of .424 gram-inches has been met.

Each scale unit on the machine's direct-reading amount meter represents .1 gram-inch of unbalance. Therefore, the operator need balance to only 4.24 scale units on the meter to be within the prescribed tolerance for each correction plane. The extreme sensitivity of the machine with dial readings which provide an amplification of unbalance effect, permits greater ease and handling speed.

Whether unbalance is read in terms of stock to be removed or length of material to be added, ease of calibration is just one important feature of Gisholt Balancers.

Unbalance in terms of gram-inches is quickly measured by this Balancer with correction made by grinding off metal.

DYNETRIC BALANCERS GISHOLT



Simple to operate, this Balancer gives fast, accurate unbalance readings in gram-inches.

Production Balancing

. . . is one of the many helpful subjects fully covered in the Gisholt Balancing School—only service of its kind available to industry. Write for details and starting dates . . . four classes scheduled for January and February.

SIMPLE SOLUTION TO SPECIAL CRANKSHAFT PROBLEM

Nordberg Shows How Big Job is Handled At Small Investment with Superfinishing

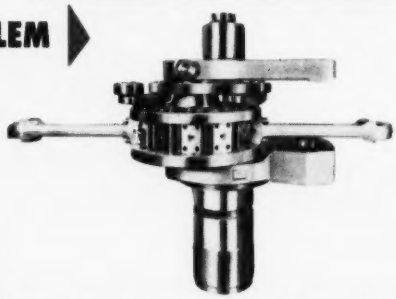
Superfinishing large bearing surface by means of attachment to boring mill.

No. 11-1253
614

Like many others, Nordberg Manufacturing Company solved an otherwise difficult problem through the simple expedient of Superfinishing. Extra-long bearing life is assured because Superfinish takes these critical surfaces down to base metal, removing the soft, annealed "smear metal" left by grinding heat.

The crankshafts in Nordberg Radial Engines have a *single* throw and require only two main bearings. With the force of 2125 h.p. acting on these bearings, as in the case of a 12-cyl. model, you can see the need for an accurately controlled bearing surface.

This is done at extremely low cost, both in equipment investment and in time—because of the adaptability of this modern process. Using existing equipment, a No. 3 Superfinishing Attachment is mounted in a standard



tool head of a vertical boring mill. The workpiece is clamped to the rotary table in the usual manner, completing the simple setup.

Superfinishing is satisfactorily accomplished with on-hand equipment . . . without the expense of a special machine for this operation.

See how the basic advantages of Superfinishing—better, longer-wearing surfaces that cost less—can be applied to your problems. The textbook, "Wear and Surface Finish," reports fully on Superfinishing: ask for it.

With a low-cost attachment for existing equipment, these very large bearings get better, longer-lasting surfaces through Superfinishing.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

Write for your copy of Gisholt's new general catalog.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

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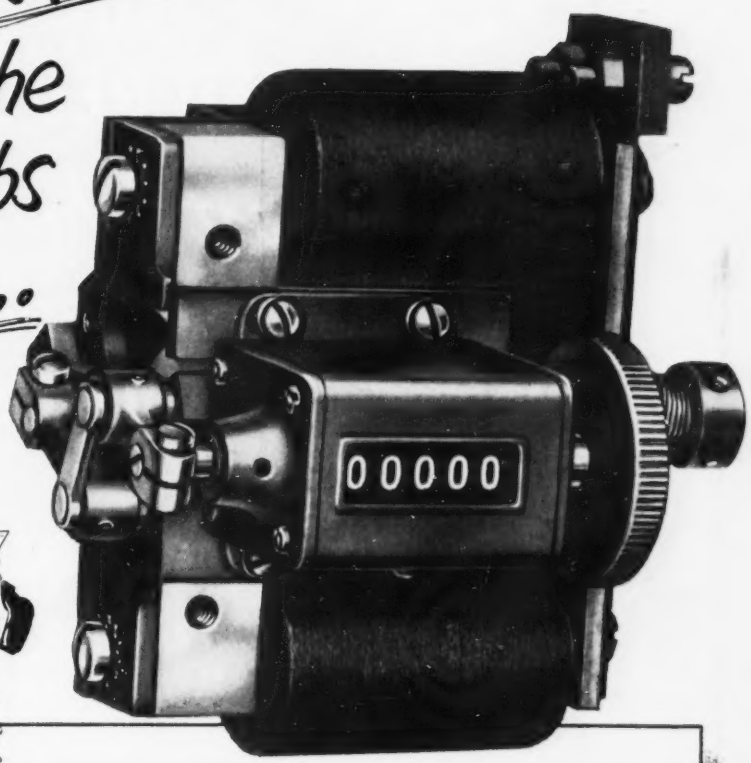
This Electrical Reporter Stays on the Tough Jobs Longer...



Added Evidence that

Everyone Can Count on VEEDER-ROOT

Compact and rugged . . . this electrically operated reset counter is specially designed for tough jobs that demand longer counter life.

Here's another instance of the *infinite applicability* of Veeder-Root *Count*rol — electrical, mechanical or manual. And here's another instance, too, of the endless resourcefulness of Veeder-Root engineering, and the ability to design a *complete counting package* that fits the job fully and exactly. Now . . . what's *your* problem?

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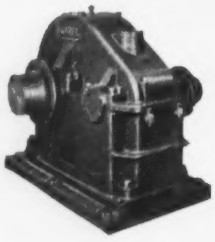
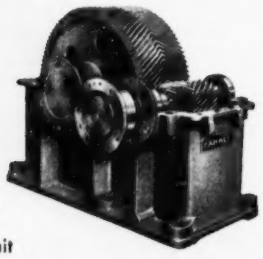
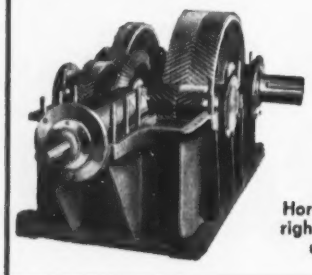


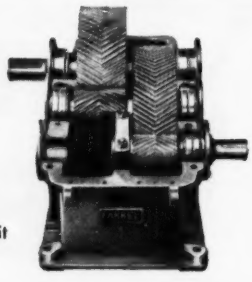
Heavy-duty single reduction unit



Standard single reduction unit



Horizontal right-angle unit



Standard double reduction unit

Farrel speed reducers start out with a better chance in life.

To begin with, the gearing in a Farrel speed reducer has teeth generated by the famous Farrel-Sykes method—a process that assures accuracy of tooth spacing, profile and helix angle. The herringbone design provides evenly distributed pressure over each tooth, from tip to working depth line. This means that there is no tendency for the teeth to wear unevenly and thus shorten the life of the gears.

Unlike most "standardized" products, Farrel speed reducers are standard only in their principal features. They are adaptable in critical detail.

The gears and pinions can be proportioned to meet specific load, speed and service requirements. Input and output shafts can be varied in size, in material and in extension. Housing dimensions can even be changed to meet problems in mounting.

For more about these adaptable units write for a copy of bulletin 449.

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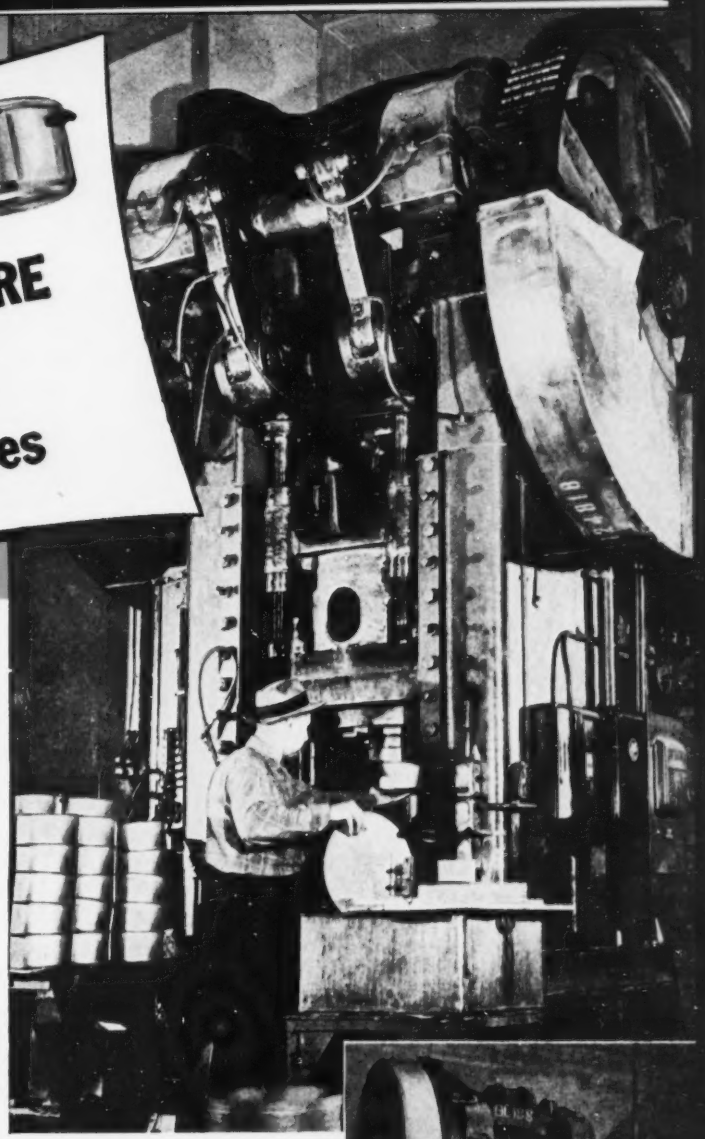
Famous FARBERWARE is 100% BLISS in drawing presses



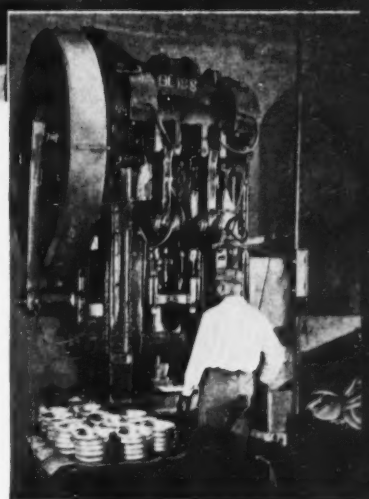
Famous Farberware begins with the finest stainless. And for dependable deep-drawing of stainless blanks, S. W. Farber, Inc. relies on Bliss toggle drawing presses—and has since 1917.

Today, the two Farberware plants are *100% Bliss* on drawing presses; *85% Bliss* on all other types.

Proven performance is the reason for this choice, of course. But here are a few of the specific operating advantages cited by H. M. Harrison, Vice President of S. W. Farber, Inc.:

1. Precision action delivers uniformly high-quality parts; keeps rejects at a minimum.
2. Bliss toggle presses are easy to set up, easy to change over; give trouble-free operation.
3. Maintenance requirements are nominal—adjustments are made quickly and easily when needed. (Floor level greasing system is a typical convenience.)

Perhaps Bliss toggle presses can solve your special deep-draw problems, too. But whatever your problems, if you're looking for high-quality, high-speed production in your press department, call a Bliss engineer. He will be glad to help you choose the *right* press for the job—mechanical or hydraulic—because Bliss makes them all.



1750 POTS IN EIGHT HOURS—that's the average production rate on this 5-S Bliss toggle. The four-quart pot is drawn 4½ inches deep in one operation from a 15-inch diameter blank of stainless.

SMOOTH BULGE on this pot cover makes it easy to clean—but calls for good press work. A rubber die is used with this 3½-B toggle press to perform this operation.

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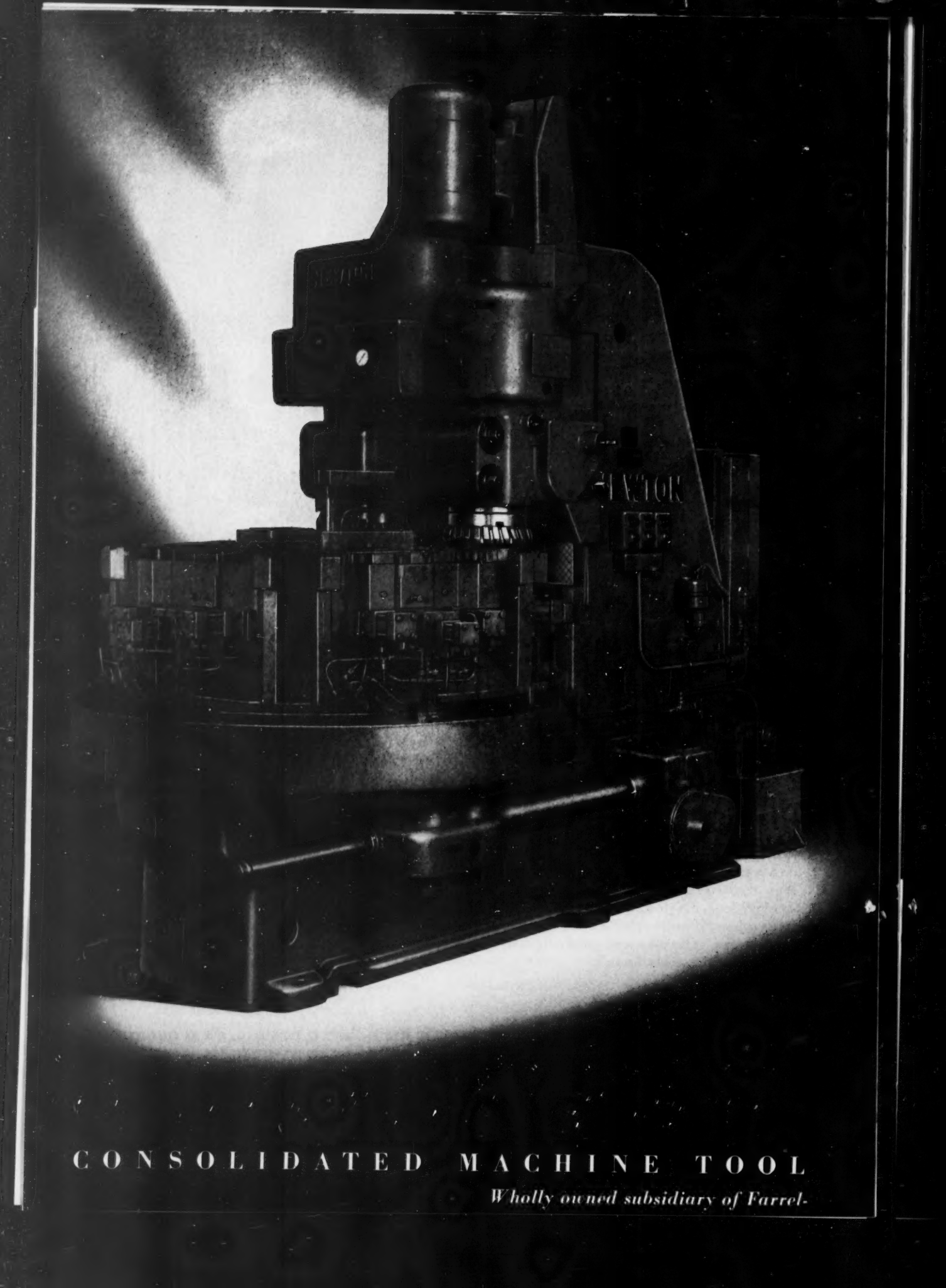

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THEY'RE SPECIAL PURPOSE FILE CUTS TO POP BUT A LOTTA FISH BONES TO STUPE!
STUPE CARRIES ONLY ONE IMPRESHUN OF A FILE!
YEAH, GOT IT SITTIN' DOWN WHEN THUH BOYS SLIPPED A HOT FILE ONTO HIS STOOL AT THUH SNACK BAR
?
HE THOUGHT IT WUZ UH PIECE O' BURNED TOAST. HAR!
STAN RANDALL

Every Nicholson or Black Diamond Special Purpose file is designed to perform specific functions on specific operations found in thousands of America's industrial concerns.

Its initial purpose is to do a better mechanical job on certain kinds of materials than can be done with regular types of files. "Better" may mean faster speed, greater accuracy, smoother finish—or a combination of all three. Its *ultimate* purpose is to minimize wastes—in rejects, time, and money.

You can rest assured that each and every type of Nicholson or Black Diamond file must have had exhaustive design engineering, rigidly controlled manufacture, and thorough testing before it is given the "green light" to public use.

• • •

Your production and purchasing heads will find it definitely worth while to absorb the specific features and applications of the Nicholson Special Purpose files covered in "FILE FILOSOPHY" and "10 SPECIAL FILE TYPES." These are two illuminating pieces of literature which may be obtained without charge simply by writing for them. (The files illustrated above, left to right, are: For Stainless Steel, Aluminum Type "A," Long Angle Lathe, Foundry, Lead Float, Curved Tooth, Super-Shear.)

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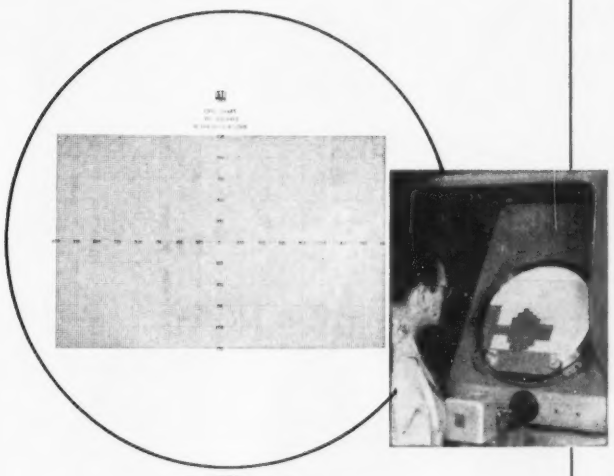

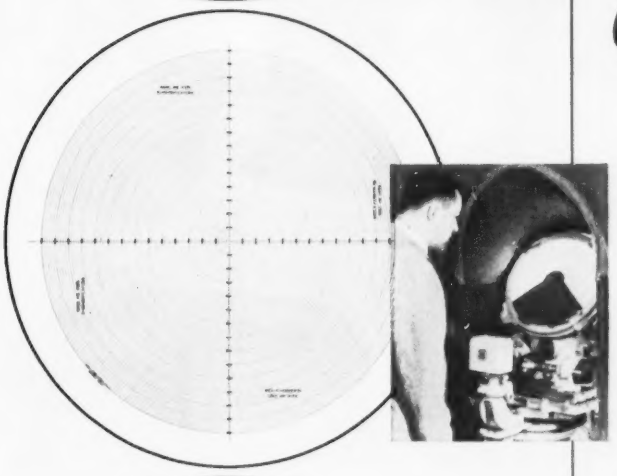

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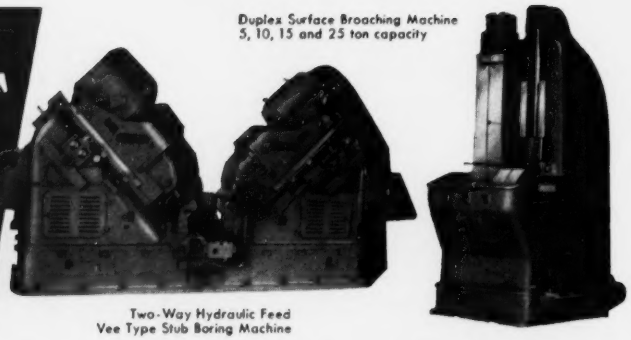
FOOTBURT

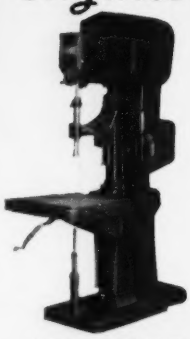
line of production machines...



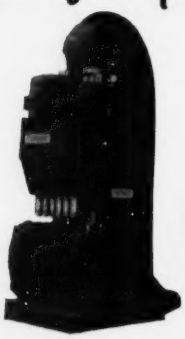
Duplex Surface Broaching Machine
5, 10, 15 and 25 ton capacity

Two-Way Hydraulic Feed
Vee Type Stub Boring Machine

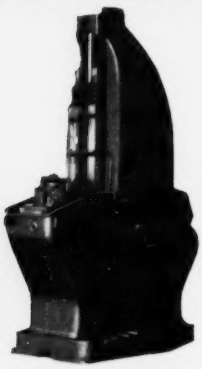
engineered for production



1, 2, 3, 4 and 6 Spindle
Sensitive Drilling Machines



Stub Type Cylinder
Boring Machines

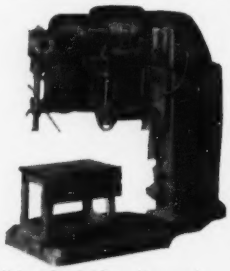


Single Slide and Broaching
Machine 5, 10, 15 and 25 Ton
capacity

● Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines...Hammond Radial Drilling Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

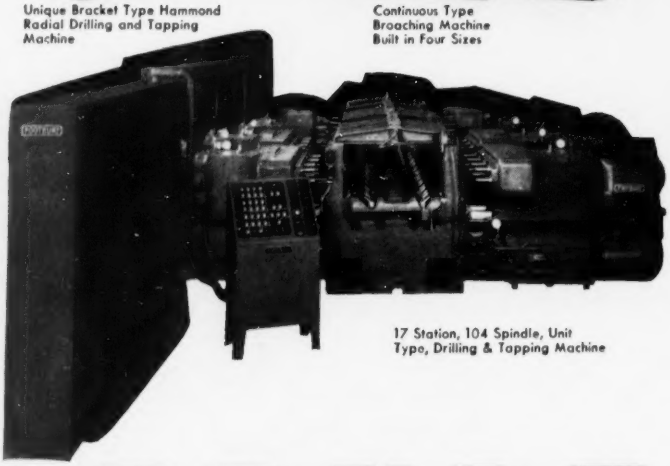
THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: General Motors Building



Unique Bracket Type Hammond
Radial Drilling and Tapping
Machine

Continuous Type
Broaching Machine
Built in Four Sizes



17 Station, 104 Spindle, Unit
Type, Drilling & Tapping Machine

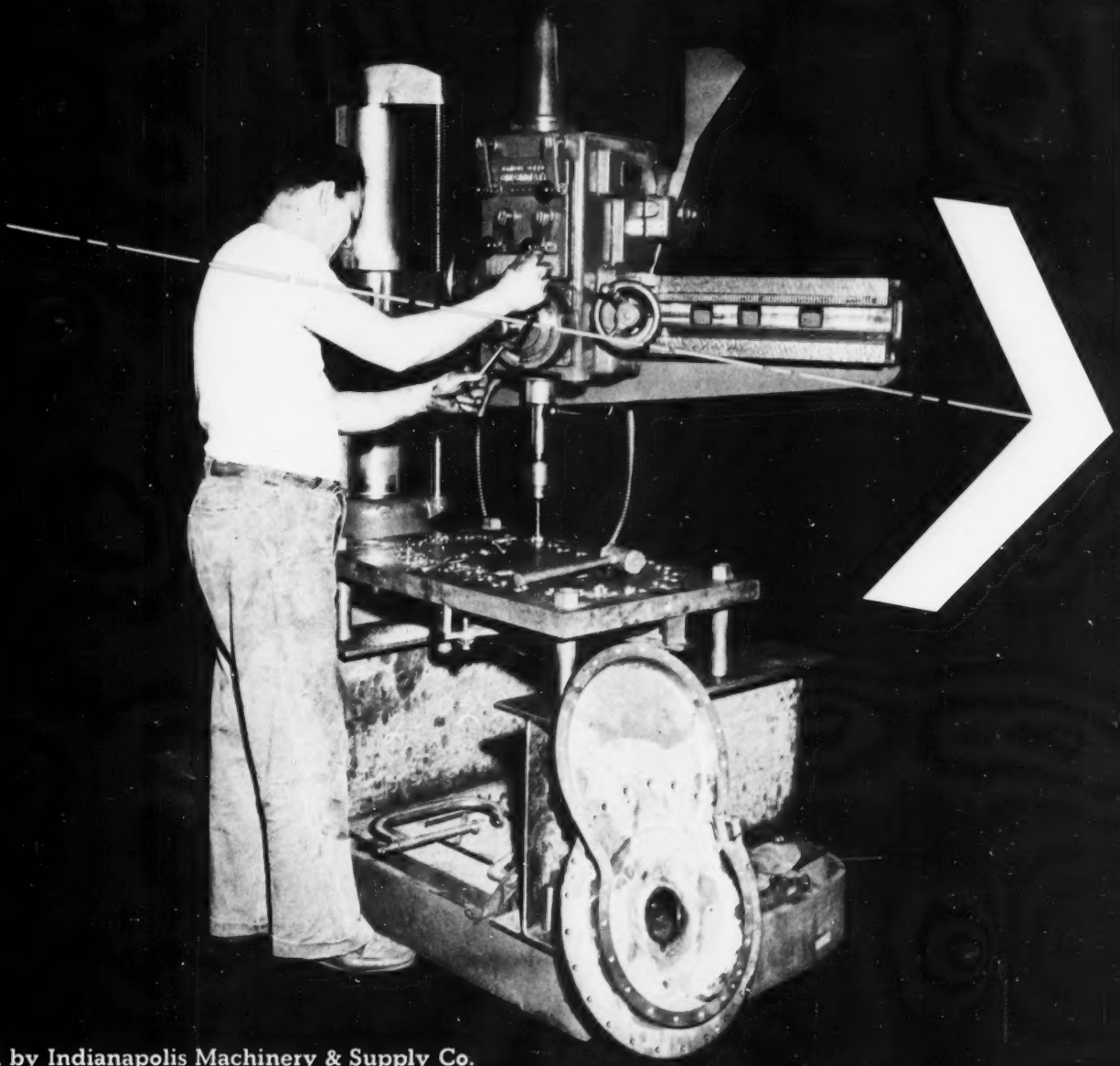
Five Way 21 Spindle Lead
Screw Tapping Machine

FOOTBURT

PRODUCTION MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 261

BALANCED PERFORMANCE



Installed by Indianapolis Machinery & Supply Co.

Drilling and tapping cast iron tank transmission parts at Dickey & Sons, Inc., Indianapolis, Indiana, one of the many job shops whose Cincinnati 3'7" Radials have "paid off" very quickly, as proven by careful record-keeping. This radial has a high "earning rate per square foot of floor space" because 1) it's inexpensive, and 2) a lot of work falls within its 1-inch capacity. Your Cincinnati representative will gladly arrange a demonstration.

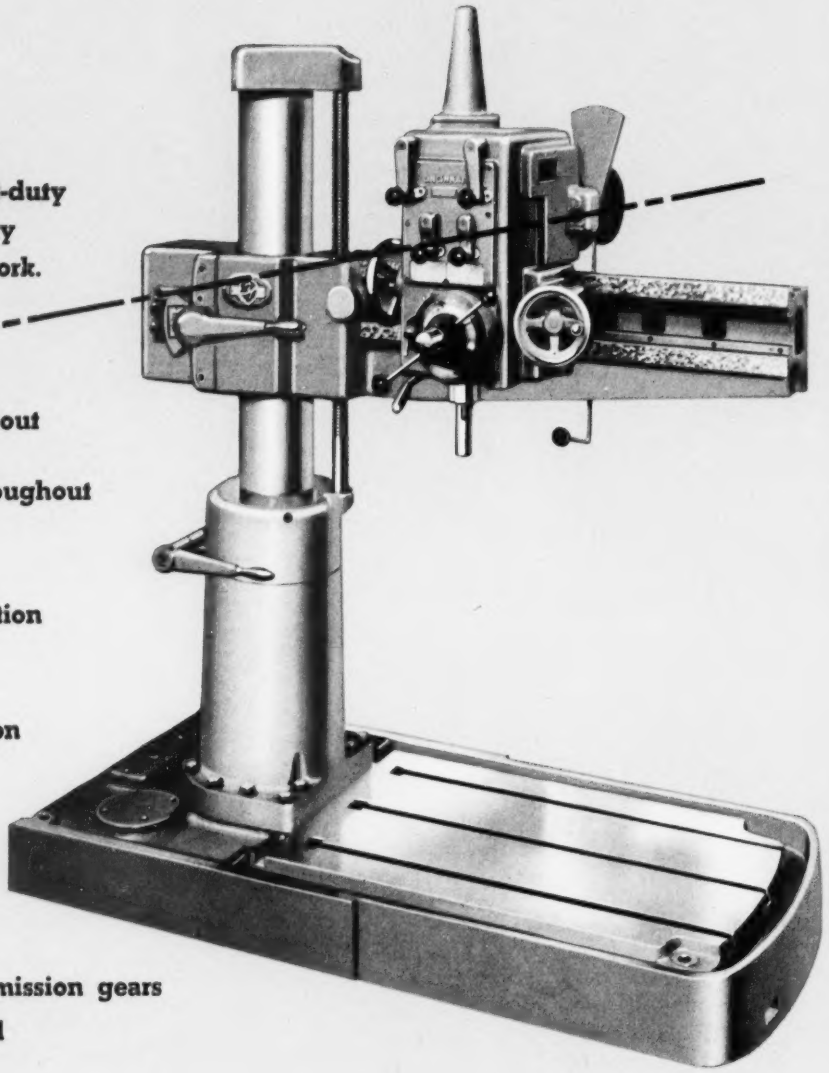
best buys in their class!

CINTIDRILL

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.

MORE WORK/DOLLAR

Cincinnati 3'7" radials are truly economy-priced light-duty machines whose 1" capacity handles a wide range of work.



Unit construction throughout

Anti-friction bearings throughout

All geared head
with automatic lubrication

9 spindle speeds
in geometric progression
30 to 1 overall ratio

6 power feeds

Simple direct drive

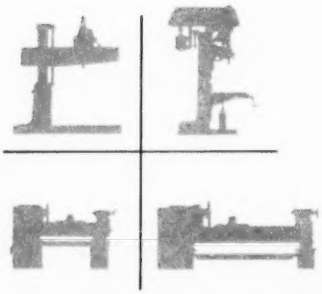
All speed and feed transmission gears
of alloy steel, hardened

This cost-saving radial is just one of the complete balanced line of Cintidrills, including 21" sliding head box and round column floor drills; 14" 3000 and 16" 3000 sliding head bench and floor drills; 16" and 18" Royal Cintidrills, bench and floor models, single and multiple spindles. Write for catalogs and name of your nearest dealer.

best buys in their class!

CINTIDRILL

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.



PRINTED IN U. S. A.

Learn how Farval can protect your machines and save you money

FARVAL—*Studies in Centralized Lubrication* No. 151

THIS new 20-page databook brings you up-to-date on centralized lubrication. In words, pictures and diagrams, Bulletin 26 shows you how simply and economically Farval systems operate.

The step-by-step operation of the unique Farval Dualine valve is presented in a series of color drawings. Its outstanding features are discussed. Detailed information on Farval systems is given, including manual systems, heavy-duty automatics, the compact automatic DC 20 specifically designed for smaller machines and the Spray Valve system designed to lubricate open gearing and slide surfaces evenly.

All about user benefits, too

Bulletin 26 also summarizes briefly the experience of Farval users. On many machines Farval eliminates 45 minutes or more out of every hour of hand-oiling labor. Farval protects bearings, thereby reducing the expense of dismantling machines. By keeping equipment steadily at work, Farval increases machine production. Farval saves 3 of every 4 pounds of lubricant used by other methods. In short, the economies due to Farval centralized lubrication usually pay for the installation in a few months and continue thereafter to pay handsome dividends.

Mail coupon today. You'll be surprised at the savings and the longer machine life you may enjoy with Farval. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

FREE—Just off press! Bulletin 26 has 20 pages of photographs, drawings, diagrams and text, to enable you to select and specify the proper Farval systems to protect your machines. Mail coupon today!

Yes, please mail my FREE copy of the new Farval Bulletin 26 without obligation.

Name_____

Title_____

Company_____

Street_____

City_____ State_____

AUTOMATIC CONTROL of lubrication pumping system by the unseen G-E process timer releases operator for full-time operation on machine; will automatically increase this machine's life.

ADJUSTING PROCESS TIMER is simple and need be done only once. Here operator adjusts the TSA-14 for lubrication cycle on the basis of a predetermined percentage of operating time.

Here's how you can . . .

Boost Operator Output with a G-E Process Timer

Because of automatic—rather than manually controlled—lubrication, an operator's output is measurably increased, machine life is prolonged, and shut-down time for repairs is reduced to a minimum. Here a General Electric TSA-14 process timer controls a motor and pump, which in turn supplies oil to various parts of the machine. The operation shown above is only one example of the many applications where the precise control provided by this timer saves manpower and prolongs machine life.

MANY APPLICATIONS

"Stopwatch accuracy"—that's how the controlling accuracy of the TSA-14 process timer is described. This preset control provides exact on or off timing for machine operations. Applications for the TSA-14 range from pumping control to the accurate timing required by chemical processes.

FOR MORE INFORMATION

Write or call your nearest G-E Apparatus Sales Office, or Authorized Agent or Distributor. Ask for Bulletin GEC-525. General Electric Company, Schenectady 5, N.Y. 603-165

You can put your confidence in—

GENERAL ELECTRIC

EASY INSTALLATION is yours with the TSA-14, which is equipped with pipe nipple for easy mounting and color code for easy wiring. Write for descriptive publication today!

For more information on products advertised, use Inquiry Card, page 261

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.

This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

ARMSTRONG
TOOL HOLDERS

Equip with
ARMSTRONG TOOL HOLDERS
for Defense production

A change over to new products, starts in the tool room and the die shop . . . starts with ARMSTRONG TOOL HOLDERS. In preparing for defense orders, the logical first step is to check your stock of ARMSTRONG TOOL HOLDERS. With the correct types for every operation, and the correct sizes for each lathe, planer, slotter and shaper, you will be able to start work on a moments notice.

ARMSTRONG TOOL HOLDERS reduce "tooling-up" to the selection of a cutter and tightening of a set screw. They permit operation at higher speeds, and heavier feeds than are customary—they enable you to produce more pieces per hour, per man, per machine.

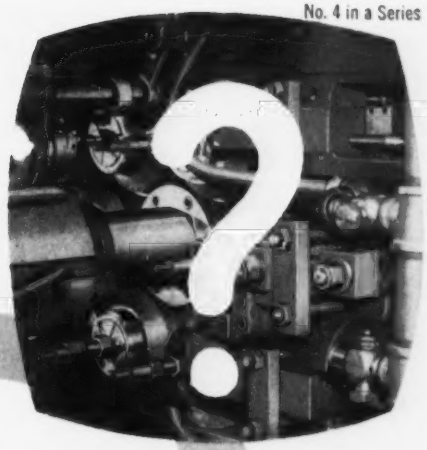
Produced by modern methods, in a specially-built tool plant, they are the lowest cost tooling you can buy. And, they are as available as your telephone for they are carried in stock by your local supply house.

Use ARMSTRONG TOOL HOLDERS wherever possible for lower tool cost, saving in High Speed Steel, increased output and greater profit. *Write for Catalog*

ARMSTRONG BROS. TOOL CO. "The Tool Holder People" 5213 W. ARMSTRONG AVENUE CHICAGO 30 ILL.

For more information on products advertised, use Inquiry Card, page 261

No. 4 in a Series



What's in it for you

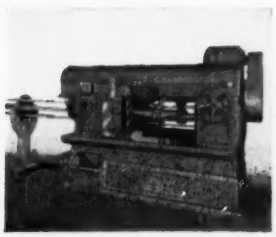
Before you buy your next multiple spindle automatic bar machine it will pay to ask your Cone Representative about the Conomatic Carbide Development program. He will be glad to tell you what's in it for you.

Among the things that your Representative can tell you is how you can be sure that any brand of "automatic", that you may have under consideration, will be equipped to get the most from any modern tool material, including 100% carbide tipped tool applications.

The part illustrated is from regular production runs with HSS and 100% carbide tipped tools. Full particulars are available.

MATERIAL—COPPER: Hole drilled with ½" dia. drill to 3" depth; taper formed on OD.

	HSS	CARBIDE
Cycle Time	45 secs.	16 secs.
Work Spindle Speed	670 R.P.M. at 110 S.F.	2026 R.P.M. at 398 S.F.
Tool Wear	150 pcs. per grind	2500 pcs. per grind

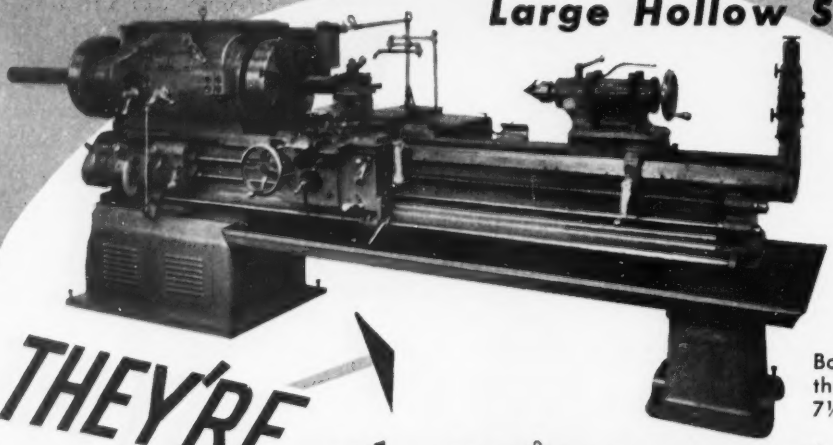


Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

FOR FASTER PRODUCTION, BETTER WORK, LOWER COSTS—

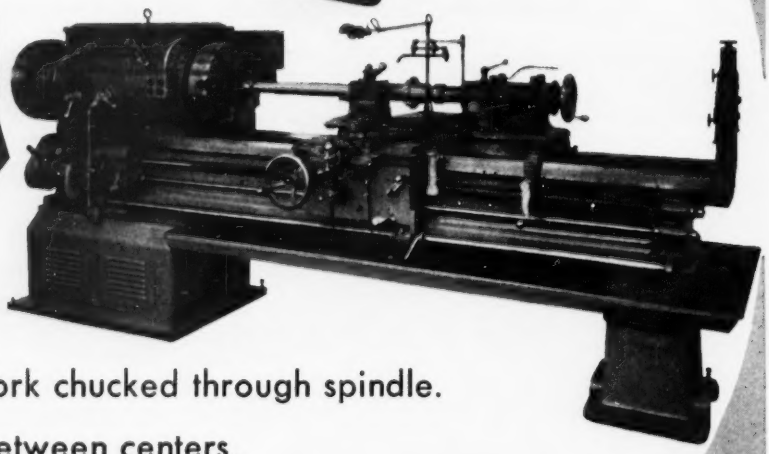
HYDRATROL LATHES

Large Hollow Spindle Type



Both Illustrations Show the 18" Hollow Spindle 7⅛" Hole

THEY'RE VERSATILE!



- Machine long work chucked through spindle.
- Machine work between centers.
- Also built with beds and carriages on each end of headstock for machining both ends of a shaft at one time.

SIZES 18" TO 36"

Small – 18" & 20" up to 7⅛" Hole
Medium – 25" up to 12" Hole
Large – 32" & 36" up to 16⅛" Hole
(Standard Type Lathes 16"-36")

IMPORTANT FEATURES

Timken Bearing Spindles.

Hydraulic clutches for forward and reverse, controlled from apron or headstock.

Hydraulic brake for close position control.

Hydraulic clutches self-compensating. No adjustment and full power capacity at all times.

LEHMANN MACHINE COMPANY

CHOUTEAU AT GRAND • SAINT LOUIS 3, MISSOURI

DIVISION OF NOVO ENGINE CO.

For more information on products advertised, use Inquiry Card, page 261

New Thompson AUTOMATIC double wheel TRUFORM Grinder speeds jet engine production

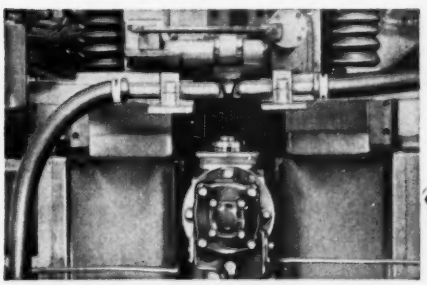
GRINDS BOTH SIDES OF JET TURBINE BUCKETS OR BLADES SIMULTANEOUSLY IN A SINGLE SETTING

To grind root sections on gas turbine buckets with greatest accuracy and productivity, Thompson developed this new AUTOMATIC double wheel TRUFORMING machine featuring simultaneous grinding of both sides of root section with one setting of work.

Grinds rough to finish in 110 seconds . . . or 30 buckets per hour

Hood doors, work clamps, coolant flow, grinding and crushing cycles are actuated in automatic sequence on the new Thompson AUTOMATIC double wheel TRUFORM Grinder.

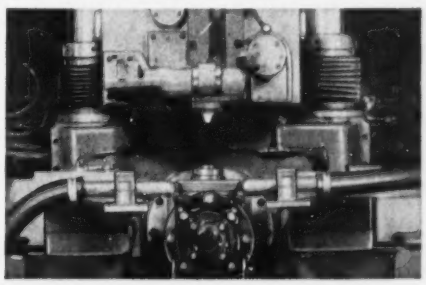
On a bucket having 2" length of form similar in design to the one in the diagram above with .150" stock removal per side from rough to finish size, production is 30 buckets per hour at a steady day after day rate. This includes down time for dressing, regrinding the crusher roll, initial machine warm up period, wheel changing and diamond changing. Actual machine time from rough forging or casting to finish is 104 seconds plus 6 seconds for loading and unloading time . . . makes total time floor to floor 110 seconds per piece.



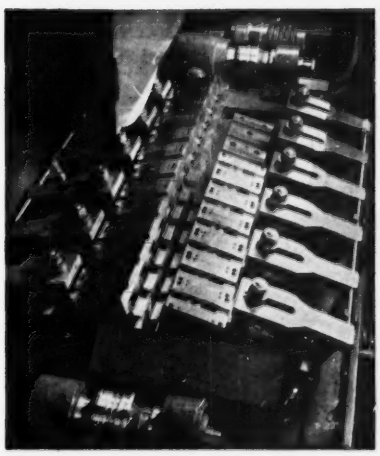
FOR ABSOLUTE SYMMETRY BOTH WHEELS ARE DRESSED FROM A SINGLE CRUSHER ROLL

GRINDING POSITION

CRUSHING POSITION

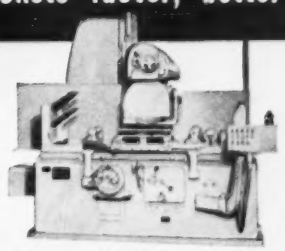


Standard THOMPSON TRUFORM Machines also grind jet buckets faster, better



By means of multiple grinding of jet turbine buckets the standard TRUFORM Grinders still offer high production plus many advantages such as flexibility of standard machine design and lower first cost. Although compared to the new AUTOMATIC the standard TRUFORM requires more skillful set up and tooling.

Typical tooling on Type "C" TRUFORM producing 24 buckets per hour. Type "B" TRUFORM produces 18 parts per hour.



Thompson Type "C" TRUFORM

FOR COMPLETE DETAILS WRITE TODAY

The Thompson Grinder Co.
Springfield, Ohio

Thompson SURFACE Grinders

COLD ROLL FORMING for Highest Strength–Weight Ratio

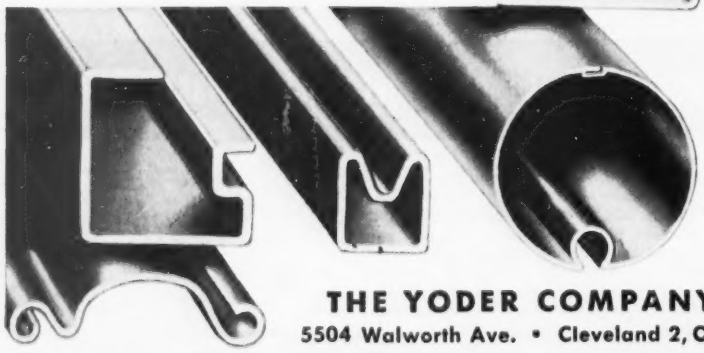
The trend in product design is strongly toward elimination of useless weight, not only in automotive and other transport equipment but also in home, office and business appliances, and other products.

Plain structural members are constantly being replaced by designed shapes made by cold-roll-forming, because of their higher strength-weight ratio and because they can be made to combine the functional with the decorative.

There are, in fact, few shapes which can not be made lighter or stronger, or both, by continuous cold-roll-forming from coiled strip than by any other method. The material saving through weight reduction often exceeds the entire conversion cost.

In making products for which the demand is growing, the installation of a Yoder cold-roll-forming machine also answers the need for higher production at greatly reduced cost, especially when other operations can be tied in with it at little or no extra cost.

Literature, recommendations and estimates, without cost or obligation.



THE YODER COMPANY
5504 Walworth Ave. • Cleveland 2, Ohio

Complete Production Lines

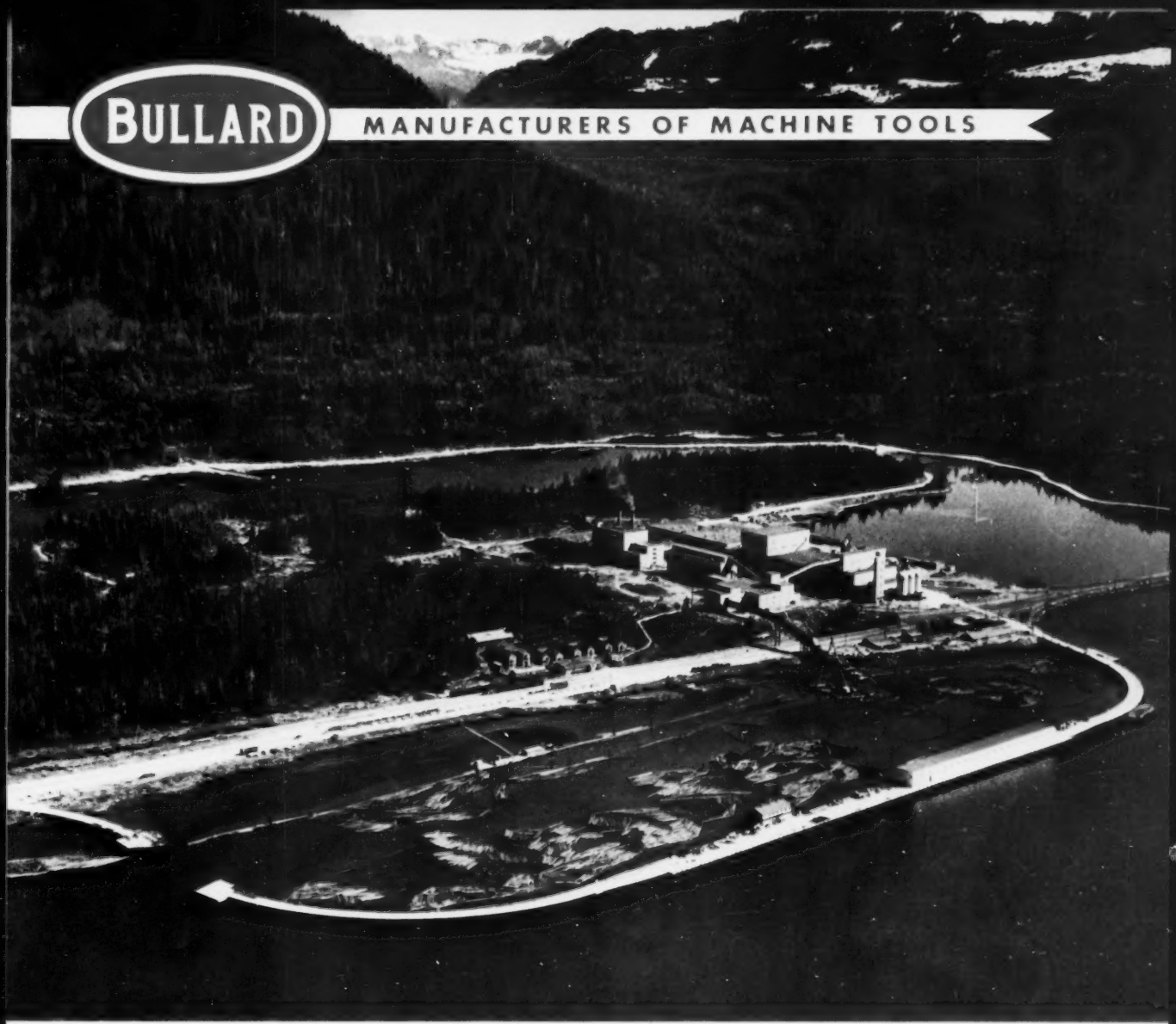
- ★ **COLD-ROLL-FORMING and auxiliary machinery**
- ★ **GANG SLITTING LINES for Coils and Sheets**
- ★ **PIPE and TUBE MILLS–cold forming and welding**

ENGINEERING YODER MANUFACTURING

For more information on products advertised, use Inquiry Card, page 261

BULLARD

MANUFACTURERS OF MACHINE TOOLS



A Large Operation in the Logging Industry

Celanese Corp. of America Photo

The Invisible Background of Industrial Progress

No doubt the general conception as to the importance of the logging industry is in its direct contribution to the building of homes, furniture and other wood products and structural forms.

It is our purpose here to point out that this industry enters into the making of paper, plastics, material for wearing apparel, upholstery of all kinds, innumerable gadgets and toys — all part of the American home. These things all emanate from "The Invisible Background of Industrial Progress."

★ In this "Invisible Background" are *Modern Machine Tools* — the manufacturing equipment which enables producers to make and distribute their products at a cost equitable with the economic structure of free enterprise.

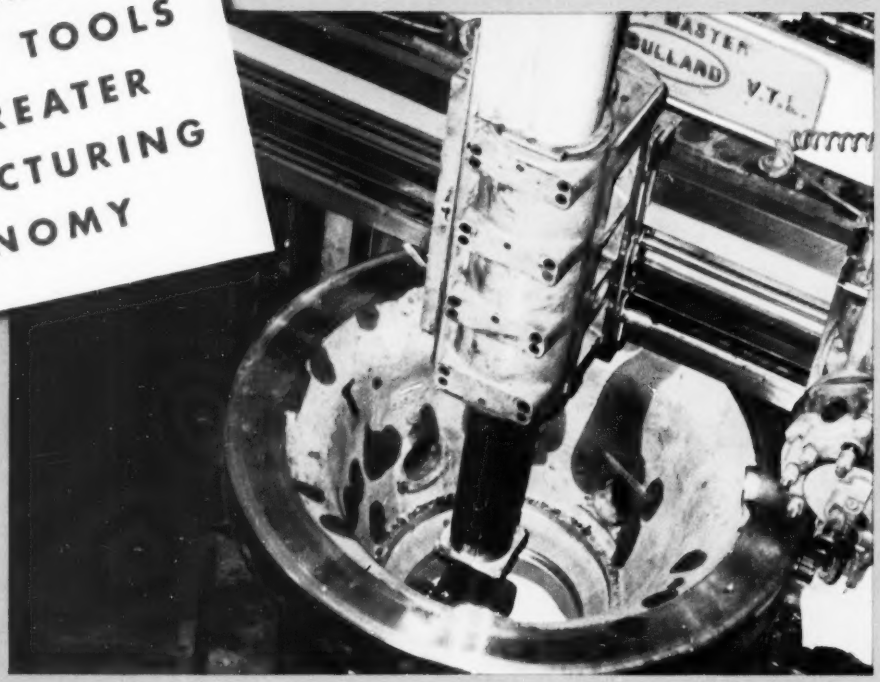
Bullard Machine Tools have in the past and will continue to play an important role in economic manufacturing progress.

★ *For greater manufacturing economy REFER to next page.*

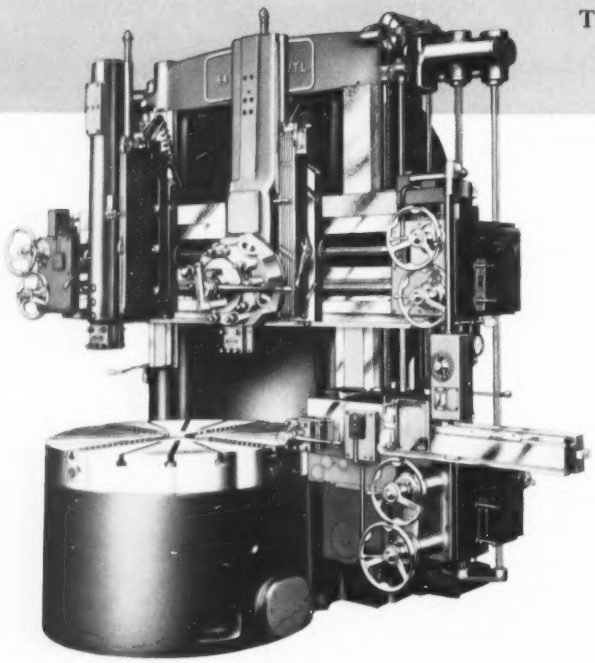
THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

BULLARD MACHINE TOOLS FOR GREATER MANUFACTURING ECONOMY



Whether the work be large or small, single piece jobs or longer production runs, The Bullard Cut Master Vertical Turret Lathe is a machine designed to meet your requirements.



Rigidly constructed with "built in" accuracy, the Bullard Cut Master Vertical Turret Lathe, available in six sizes, is everything its name implies — and more.

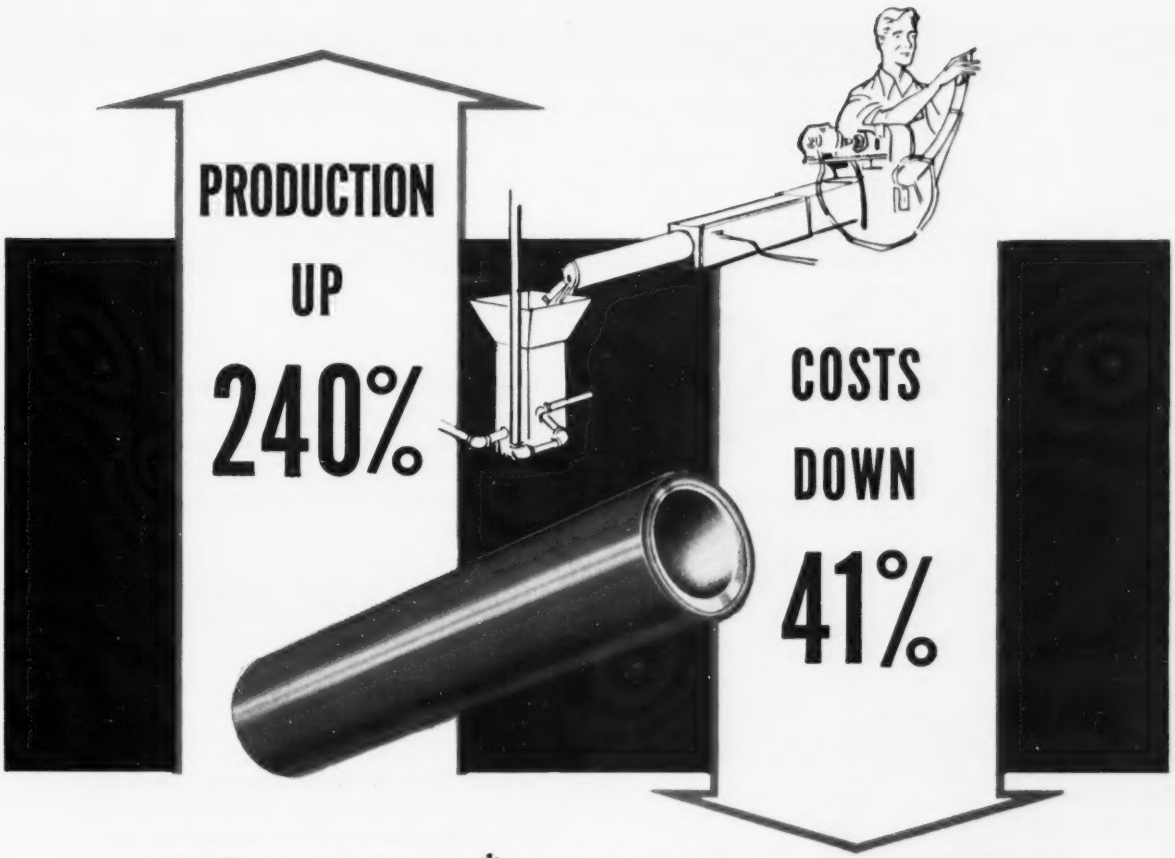
Versatility, accuracy and efficiency mean greater manufacturing economy, and in today's competitive market these factors cannot be overlooked.

Let Bullard show you how the Cut Master Vertical Turret Lathe can increase your manufacturing economy by cutting time on cuts and cutting time between cuts.

BULLARD

Time saved is money earned. Write now for complete information.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT



with TOCCO* Induction Heating

Whether you're interested in upping production or downing costs—or both—it pays to investigate TOCCO Induction Heating if you heat-treat, anneal, braze, solder, forge or melt ferrous or non-ferrous metal parts.

PRODUCTION UP—When Thompson Products Ltd., St. Catharines, Ontario switched from conventional methods to TOCCO Induction Hardening of their automotive wrist pins, production rose from 500 to 1200 per hour.

COSTS DOWN—While production jumped, costs fell from $5.46 per hundred parts to $3.23—a savings of more than 2c per pin or $26.76 per hour on the hardening operation alone.

OTHER ADVANTAGES—Additional savings result from elimination of hauling wrist pins to and from the heat-treat department. Cool, clean TOCCO fits right in the production line, next to related operations—takes only ¼ the space of the pusher-type furnace previously used.

In Canada or the United States TOCCO engineers are glad to survey your operations for similar cost-cutting results—no obligation, of course.

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-11, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating".

Name_____

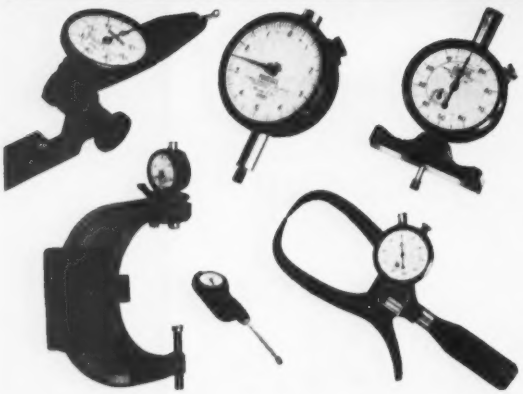
Position_____

Company_____

Address_____

City_____ Zone____ State____

FEDERAL

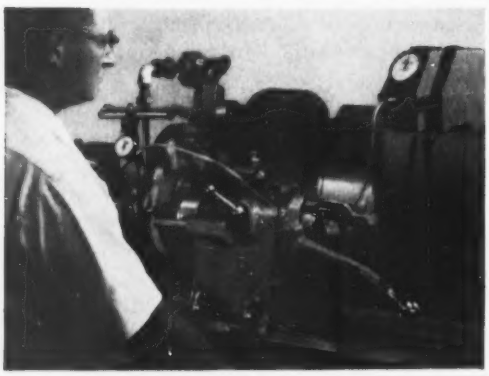


Indicators — over 80 different models, ranges, sizes, graduations, styles — for every accuracy, space, and visibility requirement. Indicating Gages of all types including snap, hole, depth, caliper, etc., and special.

DIAL INDICATORS AND GAGES

Federal Dimensionair: Greatest measuring range of any air gage — .003" with 2500 to 1 magnification. Most modern air gage. Available in various applications and combinations with Electrical and Electronic gages. *Send for new complete catalog.*

AIR GAGES



Grinding operations automatically and consistently size controlled — with exceptional accuracy. Also bare wire, insulated wire, glass tubing, steel rods, sheet, and similar continuous material is not only gaged in process but size-controlled by automatically adjusting the machine to compensate for variations out of tolerance.

MACHINE CONTROL GAGES

Call us in on the job when you start planning your gage requirements. We have helped many plants solve their gaging problems and we can help you too. Let us know your requirements. Federal Products Corporation, 1111 Eddy Street, Providence 1, Rhode Island.

has *Everything* in Gages for Dimensional Control

Multiple dimensions inspected simultaneously and quickly. (1) A single or individual light indicates at a glance if one or more dimensions are wrong. Or (2) separate lights identify incorrect dimensions and indicators show *how much*.

PICTURE PANEL GAGES

Invaluable for selective assembly methods of production. Parts are measured and sorted into any number of dimensional categories with great accuracy and speed. 100% inspection without interfering with production schedules. Semi-automatic or hand fed.

AUTOMATIC SORTING GAGES

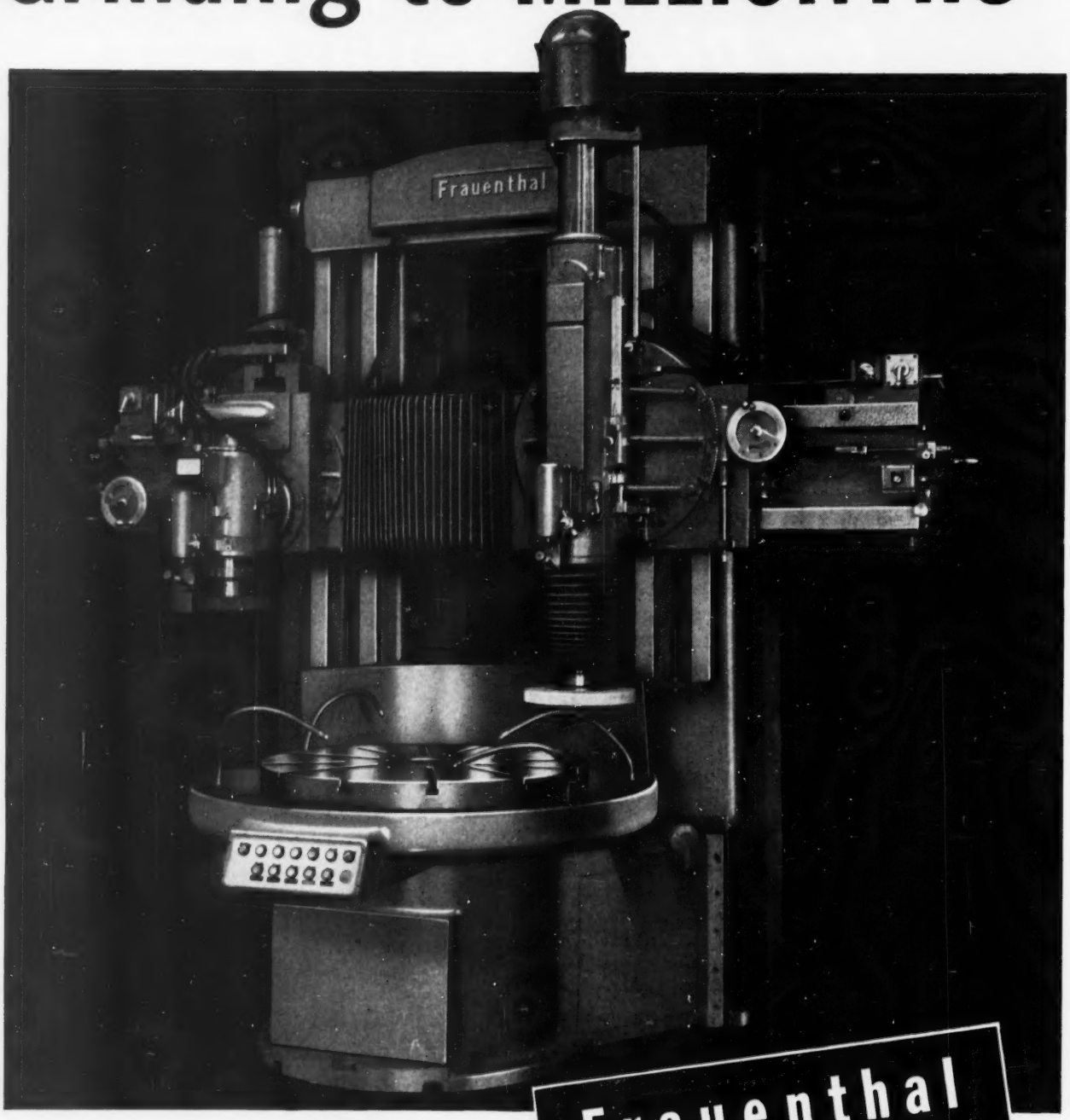
Federal can process engineer, design, and build complete sets of gages for any production job: Can often save money for you by modifying *stock* gages. Consult Federal before you process your next job. Save time and money and get better gages.

ENGINEERING GAGE SERVICE

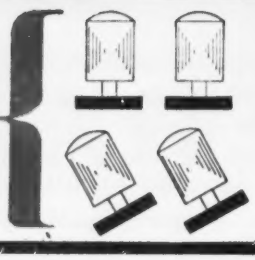
FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing *all* types of DIMENSIONAL INDICATING GAGES

Grinding to MILLIONTHS



Many combinations of spindle positions for simultaneous grinding on all sizes of Frauenthal Grinders



Frauenthal Grinders

MULTIPLE-HEAD
SUPER-PRECISION
VERTICAL

PRECISION-GRIND INSIDE, OUTSIDE AND FACES SIMULTANEOUSLY TO MILLIONTHS OF AN INCH!

# of an inch precision with Frauenthal Grinders

IMPOSSIBLE! **...said one machine tool man**

UNBELIEVABLE! **...said another, skeptically**

SHOW ME! **...said a progressive executive**

THIS **is what we have shown many:** You can get such super-precision grinding with these unique grinders that *the normal method of expressing tolerances in tenths-of-thousandths of an inch became inadequate* when precision was attained to *fractions of tenths-of-thousandths, expressed best in MILLIONTHS of an inch.*

AND *THIS* IS PERFORMANCE-PROOF... details on request

PRECISION GAUGE READINGS • CHART NO. 1

MAX. VAR. IN FACE THICKNESS (Parallelism)				MAX. VAR. IN WALL THICKNESS (Eccentricity)			
Station	Reading	Station	Reading	Station	Reading	Station	Reading
1	.000000"	7	.000000"	1	.000000"	7	+.000020"
2	+.000010"	8	+.000020"	2	+.000010"	8	+000010"
3	+.000030"	9	+.000030"	3	+.000020"	9	.000000"
4	+.000030"	10	+.000030"	4	+.000020"	10	−.000010"
5	+.000030"	11	+.000030"	5	+.000010"	11	−.000020"
6	+.000010"	12	+.000020"	6	+000020"	12	−.000010"
Maximum Variation in Parallelism: .000030"				Maximum Variation in Eccentricity: .000040"			

PRECISION GAUGE READINGS • CHART NO. 2

MAX. OUT-OF-ROUND ON O. D.				MAX. OUT-OF-ROUND ON I. D.			
Station	Reading	Station	Reading	Station	Reading	Station	Reading
1	.000000"	4	−.000050"	7	.000000"	10	−.000110"
2	−.000020"	5	−.000080"	8	.000000"	11	−.000070"
3	−.000040"	6	.000000"	9	−.000050"	12	.000000"
Maximum Variation, Outside Diam: .000080"				Maximum Variation, Inside Diam: .000110"			

What is YOUR grinding problem?

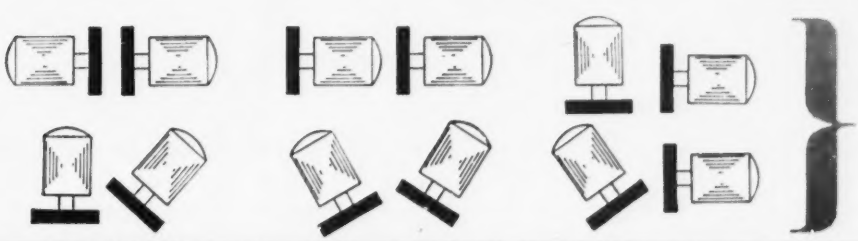
We'll be glad to work with you on difficult grinding, boring, turning problems. A wide variety of combination grinding of outside and inside diameters or faces can be made SIMULTANEOUSLY to assure utmost precision and unfailing interchangeability of parts. Adaptations for specific jobs also can be engineered into these grinders for high production at low cost.

TEN STANDARD SIZES conforming to essential J.I.C. specifications

SERIES	TABLE SIZES	MAXIMUM SWING
1800	30"	60"
	36"	60"
	42"	60"
	48"	60"
2000	60"	72"
	72"	88"
2200	110"	120"
	120"	130"
	130"	140"
	140"	150"

Frauenthal Division

THE KAYDON ENGINEERING CORP. • MUSKEGON, MICHIGAN



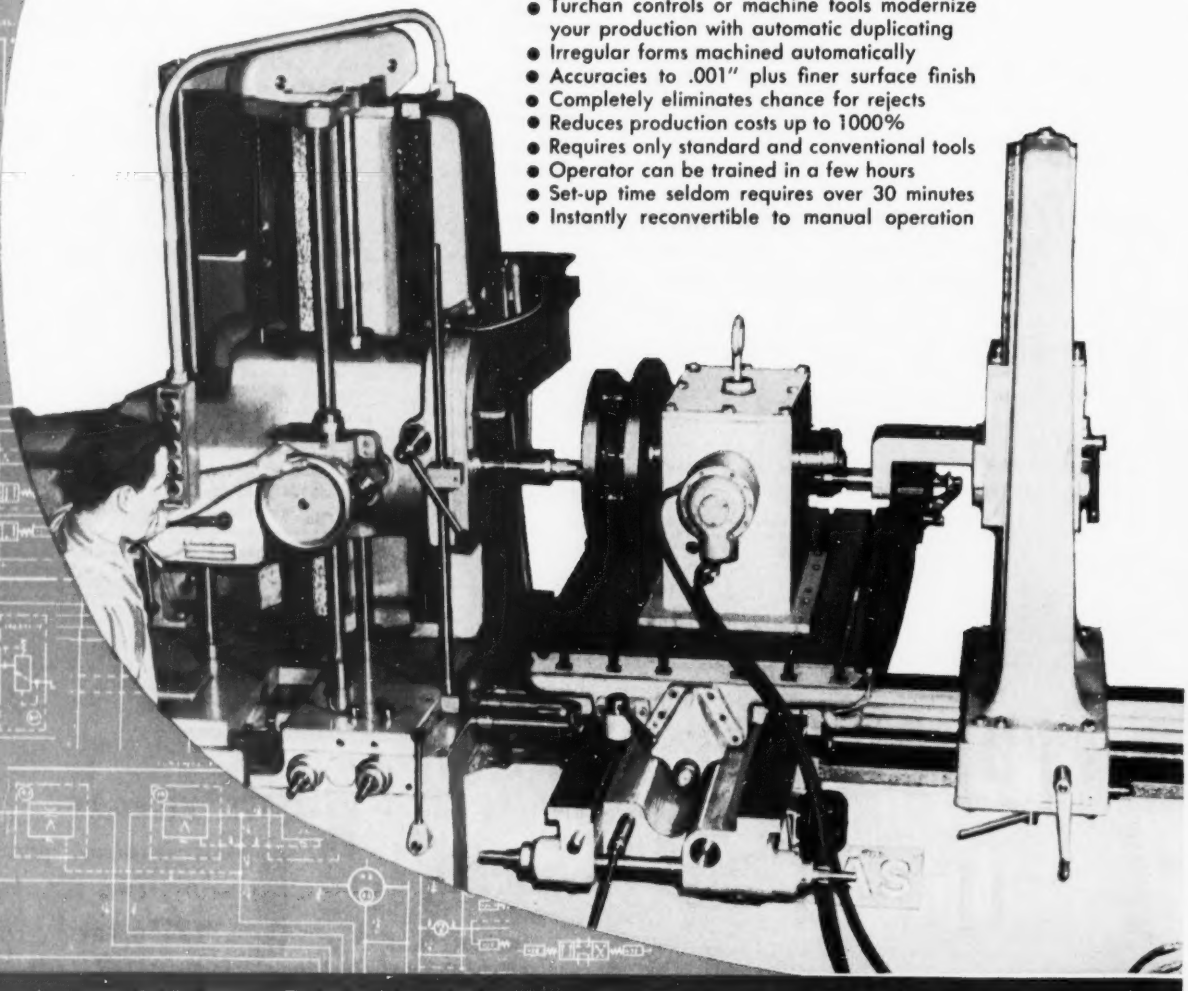
WRITE for Bulletin

Turchan has what industry needs in the trend to Automation

MODERNIZE YOUR PRESENT MACHINES WITH TRACER CONTROLS

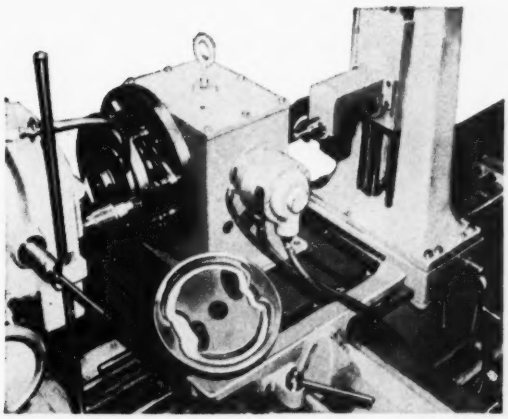
or replace by new tracer-controlled machine tools

- Turchan controls or machine tools modernize your production with automatic duplicating
- Irregular forms machined automatically
- Accuracies to .001" plus finer surface finish
- Completely eliminates chance for rejects
- Reduces production costs up to 1000%
- Requires only standard and conventional tools
- Operator can be trained in a few hours
- Set-up time seldom requires over 30 minutes
- Instantly reconvertible to manual operation

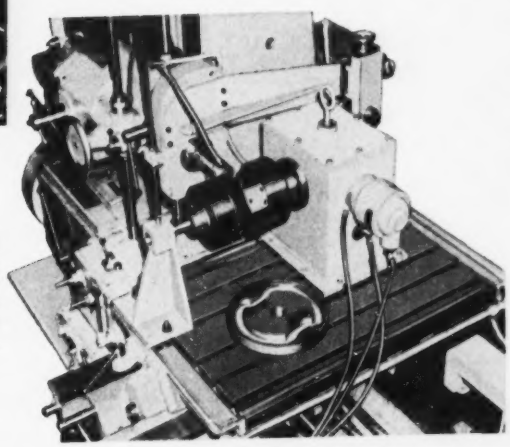


TURCHAN FOLLOWER

For full information write CONTROL SYSTEMS DIVISION



This Turchan control system consists of fluid drive rotating mechanism for turning the work piece and fluid drive for longitudinal and cross movement of table, automatically reproducing the exact template form.



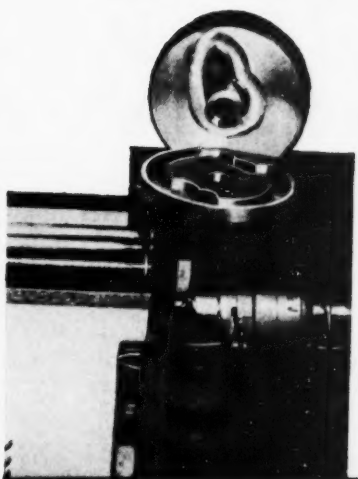
Face or barrel cams machined by rotating the template and work piece. Template actuates tracer valve which controls rate of rotation and longitudinal or cross movement of table. Both cams machined with same controls system by repositioning fluid drive and tracer.

Columbus-McKinnon Chain Corp. reports on barrel and face cams:

Without TURCHAN: layout and milling to .010″ averaged_____48 hours

With TURCHAN: Set-up (no layout) milling to .002″ averaged___ 4 hours

Production time reduced by 44 hours

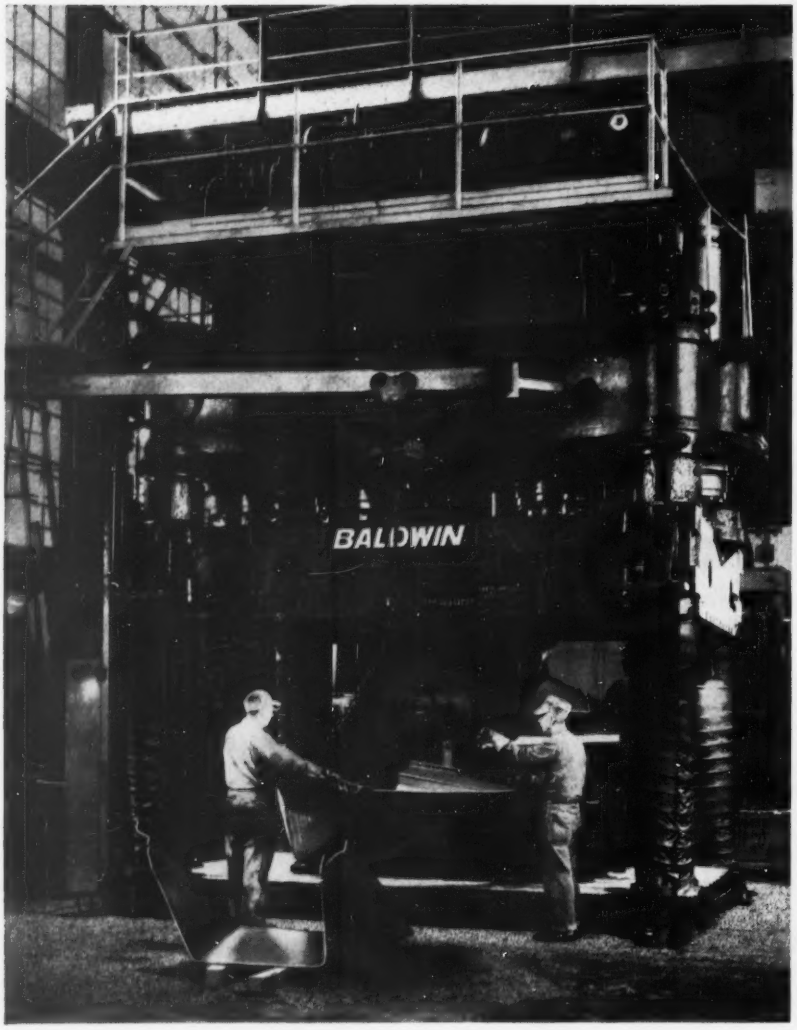


Machining intricate barrel and face cams by ordinary manual method at Columbus-McKinnon was a tedious, time-consuming, and costly operation until Turchan control systems engineers were called in to develop the hydraulic and electrical controls that now accomplish this difficult machining work in one-twelfth the original time. Why not use Turchan's 20 years' experience in control systems to simplify your machining problems. Your job costs will be *lower*, production *faster*, products *better*, with Turchan automatic tracer controls applied to your standard or special machine tools.

Manufacturers of Servo Systems • Servo Valves • Cylinders
Flow Control and Shut Off Valves • and all Hydraulic Components

MACHINE COMPANY

8259 LIVERNOIS AVENUE, DETROIT 4, MICHIGAN



THE PRESSING PROBLEM:

In order to press hopper chutes in one operation, Despatch Shops, Inc., East Rochester, N.Y., needed a rugged press with at least 72 inches of daylight.

THE BALDWIN SOLUTION:

This 1,500 ton Baldwin hydraulic press (at left) not only provides 80 inches of daylight but also has exceptional strength and power.

DESPATCH SHOPS, INC., REPORTS:

"Our rugged Baldwin press, *with 80 in. of daylight,* enables us to press hopper chutes in one operation"

What's your pressing problem?

Baldwin-Lima-Hamilton's unsurpassed experience and facilities are ready to help you solve *your* pressing problem. For further facts about B-L-H presses for metalworking, please write Dept. 4419, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Producing hopper car chutes, side stakes, freight car ends and roofs used in the manufacturing of refrigerator and hopper cars, this Baldwin press benefits Despatch three ways:

1. Since its design allows a full 80 inches of daylight, this Baldwin press permits ready handling of very deep shapes such as the hopper chutes being formed in the above photographs.
2. The ease with which this press can be controlled is extremely advantageous because it is necessary for the operator to be able to maintain very accurate control of pressure on the parts being formed.
3. The exceptional strength and power of the Baldwin press is evident particularly in the platens and platen guides. This ruggedness of design helps account for the fact that maintenance costs for the B-L-H press have been negligible.

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

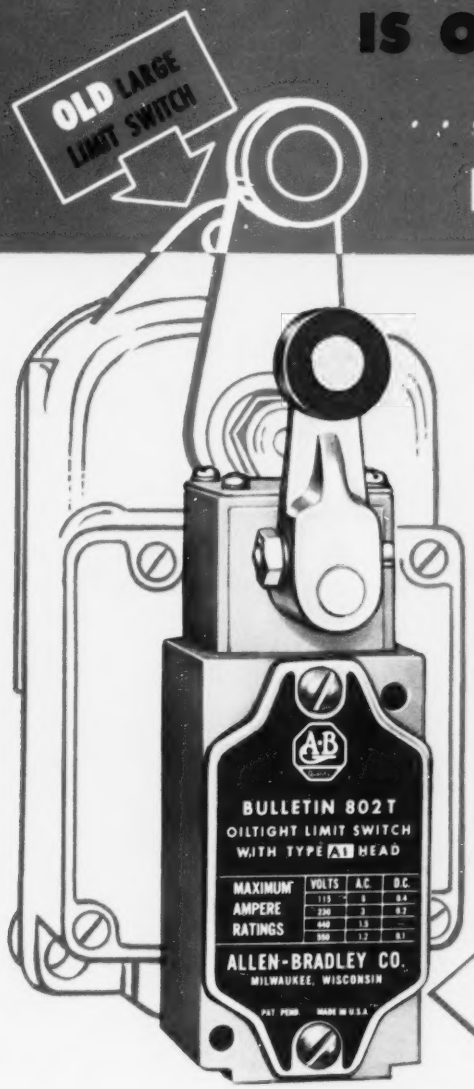
For more information on products advertised, use Inquiry Card, page 261

OVERSIZE

IS OFTEN A HANDICAP

. . . . . *especially in*

LIMIT SWITCHES



Limit switches are intended for switching pilot circuits only. Hence, nothing is gained in making limit switches large and heavy. In fact, the excessive impact of high inertia, oversize parts may actually shorten the working life of the moving elements and contacts.

Look at the new, compact Allen-Bradley limit switch. Compare it with the old, oversize unit. The new limit switch has no useless bulk . . . no excess weight . . . yet it is good for millions of trouble free operations.

Quickly Adapted to Any Location . . .

The Bulletin 802T oiltight limit switch has double break, maintenance free, silver contacts.

Various operating heads are available with different types of push rods and levers. Limit switches in flush type construction can also be furnished.

The operating heads may be mounted in any one of four positions to fit any location on your machines. Since operating heads are interchangeable, the heads and bases may be stocked separately . . . and thus simplify your inventory problems.

NEW SMALL A-B LIMIT SWITCH

The Bulletin 802T oiltight limit switch is a real pacemaker in up-to-the-minute design and performance. It is rated for operation on alternating or direct current at 115, 230, 440, and 550 volts. If you use limit switches, by all means send for our illustrated Bulletin 802T which shows the various types of operating heads available for various limit switch applications.

A-B Quality

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

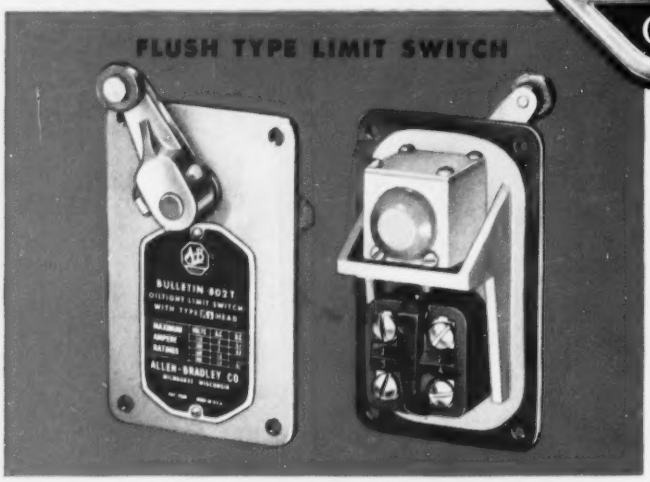
ALLEN-BRADLEY
LIMIT SWITCHES

9-53-MR

OILTIGHT LIMIT SWITCHES

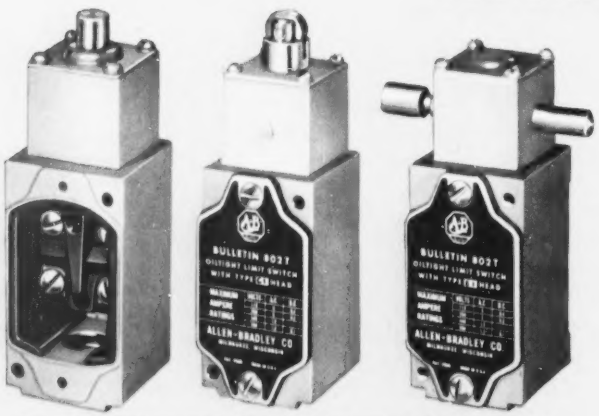
A-B Quality

The Sign of Quality in Motor Control



The operating head, with lever or push rod, may be set in 4 horizontal locations, each 90 degrees apart.

A COMPLETE LINE OF COMPACT, DEPENDABLE LIMIT SWITCHES FOR OILTIGHT MACHINE TOOL SERVICE

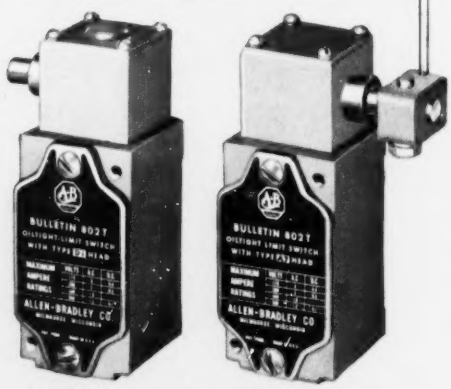


Operating heads are available with various push rods and levers. The switch is a single pole, snap acting unit, with one normally open and one normally closed contact, electrically separated. Most of these limit switches can be supplied for spring return or maintained contact operation.

The compact, streamlined design of these Bulletin 802T limit switches marks a new advance in motor control engineering.

The name plate cover has a synthetic rubber gasket to exclude oil. Terminals are easily accessible by removing the name plate. The switch body is threaded for ½ inch conduit. Let us send a sample for your inspection.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.



Bulletin 802T oiltight limit switches can be mounted from the front, using the two clearance holes shown above. For mounting from the back, two tapped holes are provided in opposite corners.

ALLEN-BRADLEY QUALITY
LIMIT SWITCHES

9-53-MR

GEARS

any size, any quantity

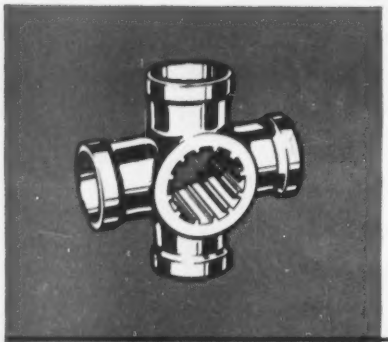
Spur	Splines
Helical	Coniflex Bevel
Spur Internal	Spiral Bevel
Helical Internal	Zerol
Rack	Hypoid
Herringbone	Intermittent
Worm	Sprockets
Non-Metallic	

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

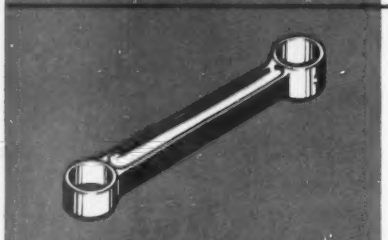
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



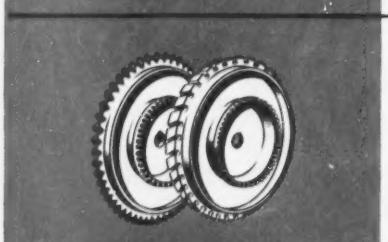
DETROIT BROACH TOOLS PROPELLER HUBS

Detroit Broach tooling for aircraft engine parts began with reciprocal engine designs. A typical example was the Detroit Broach tooling to produce the spline inside propeller hubs. In one pass, broaching produced a complete spline with consistent accuracy. This led to more accurate spline broaching in many other fields, too.



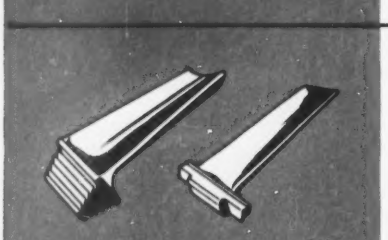
DETROIT BROACH TOOLS ARTICULATING RODS

As radial engines came to the forefront, new challenges in precision tooling were met by Detroit Broach ingenuity. Typical of reciprocal engine parts broached were articulating rods. Detroit Broach tooling produced a better finish and greater accuracy on the machined surfaces of these parts.



DETROIT BROACH TOOLS TURBINE AND COMPRESSOR WHEELS

With the advent of jet engines, the need for close-tolerance repetitive accuracy was even more acute. In addition came the problem of working with high-alloy, heat-resistant, tough-machining metals. Compressor and turbine wheels are typical of the parts for which Detroit Broach tooling is meeting all requirements with flying colors. Varied forms of slots are produced in these wheels, square, at helix and at conical angles to the axis.



DETROIT BROACH TOOLS TURBINE AND COMPRESSOR BLADES

Mating parts to compressor and turbine wheels, the compressor and turbine blades are two more parts on which Detroit Broach tooling turned the trick. Intricate "Christmas Tree" forms, dovetail and "Ball Root" forms are easily produced with accuracy. At the same time, production costs are rock-bottom and surface finishes generally need no further machining.

This is a view of the new, ultra-modern Detroit Broach plant and offices located in Rochester, Michigan—just outside Detroit. Designed by Sture Frolen, eminent Swedish architect, it embodies many important advancements that contribute to employee morale and manufacturing efficiency. Another example of the unusual facilities of Detroit Broach Company.

Broaching Pioneers

IN THE AIRCRAFT INDUSTRY

Since the price of poor fits on engine parts may be paid in human lives, the aircraft industry was quick to recognize and adopt the inherent accuracies of broaching.

It was quick, too, to recognize the ability of Detroit Broach to engineer and produce tooling that met the need for concise repetitive accuracy . . . tooling with important production economies as shown on the opposite page.

in YOUR industry, too you will find many examples of Detroit Broach tooling that is producing repetitive accuracy, part after part after part. Just as important, it is tooling that consistently makes good common sense in terms of efficient operation and rock-bottom cost-per-piece broached.

These benefits that accrue Detroit Broach customers are not achieved by magic or by gift. They are the result of years of specialization in one important field . . . broaching. Every person, every machine, even plant facilities at Detroit Broach are geared to that single purpose.

In broaching it will pay you, too, to have a talk with Detroit Broach Company . . . pioneers in broaching yesterday, today, and tomorrow.

Detroit Broach **COMPANY**

ROCHESTER, MICHIGAN

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

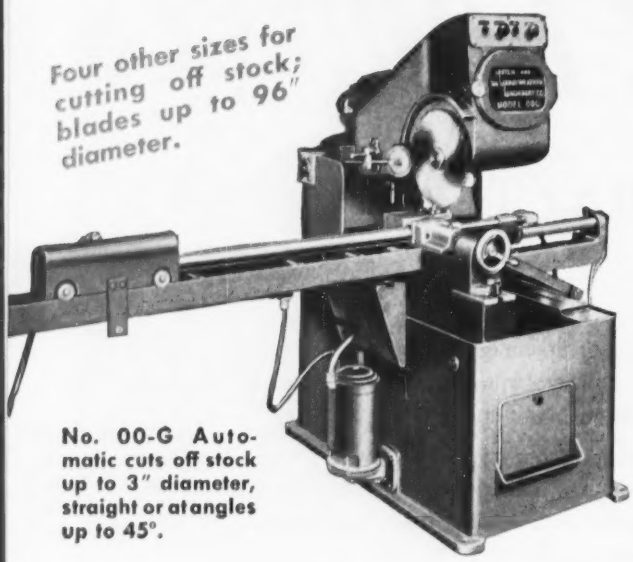
USE MOTCH & MERRYWEATHER ENGINEERING

NO LET-UP. Whether in a war-time or peace-time economy, America's levels of effective production must be sustained and raised. New highs must be reached and surpassed. Constant advances in machine tool purpose and design must promote the nation's industrial progress. To these ends Motch & Merryweather engineering is continuously directed. Typical machines are illustrated here.

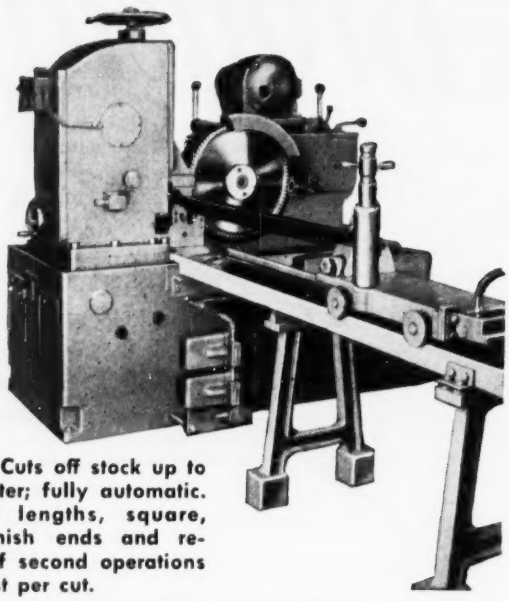
MOTCH & MERRYWEATHER Circular Sawing Machines

to cut off every size and shape of stock, ferrous or non-ferrous.

Four other sizes for cutting off stock; blades up to 96" diameter.



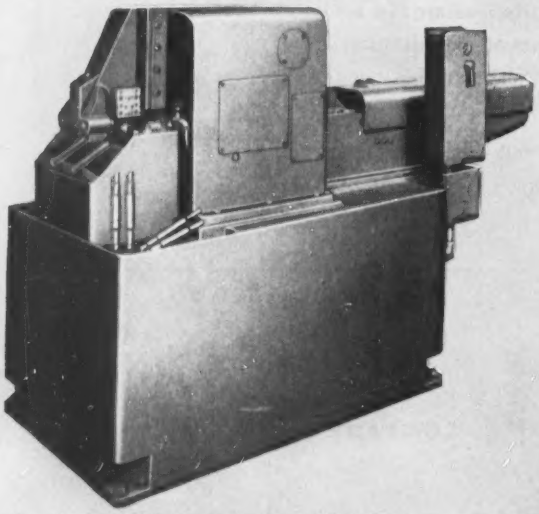
No. 00-G Automatic cuts off stock up to 3" diameter, straight or at angles up to 45°.



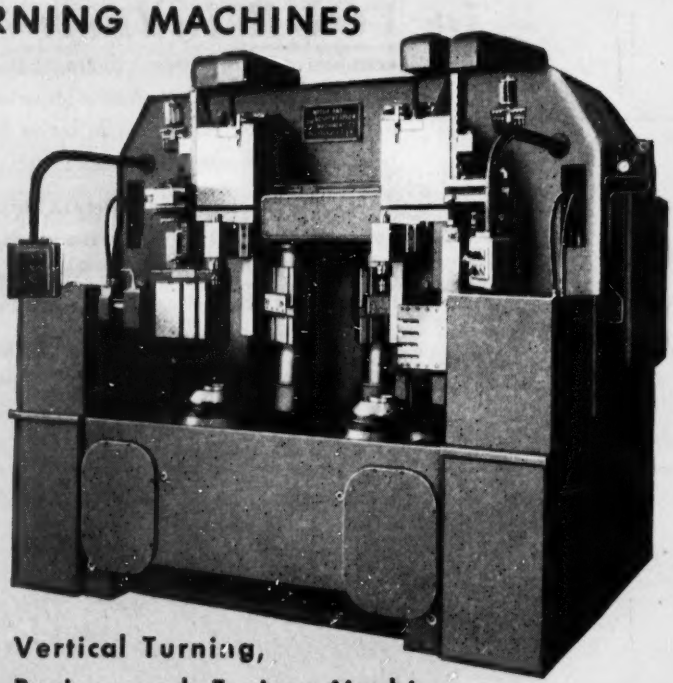
No. 2-A. Cuts off stock up to 6" diameter; fully automatic. Accurate lengths, square, milled finish ends and reduction of second operations lower cost per cut.

Motch & Merryweather TURNING MACHINES

Cam Automatic Forming Machines



Single- and double-spindle models. Hopper loading or bar feeds. All movements actuated by single cam shaft.

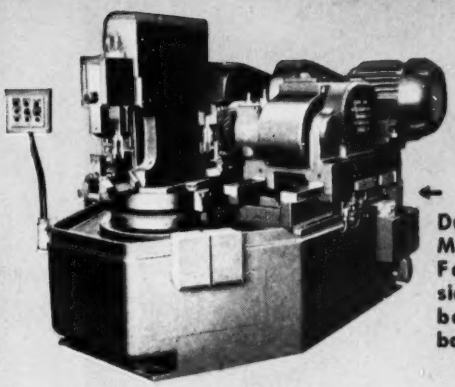


Vertical Turning, Boring and Facing Machines

Single- or double-spindle. Multiple tool blocks hydraulically fed with automatic sequence for maximum metal removal.

FOR NEW POTENTIALS IN ADVANCING PRODUCTION

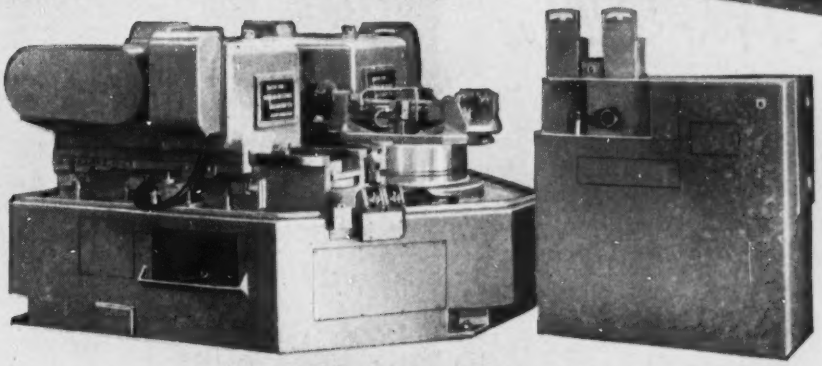
Heavy Duty Production Milling Machines



Duplex Production Milling Machine. Face mills both sides of tractor side bars. Up to 268 bars per hour.

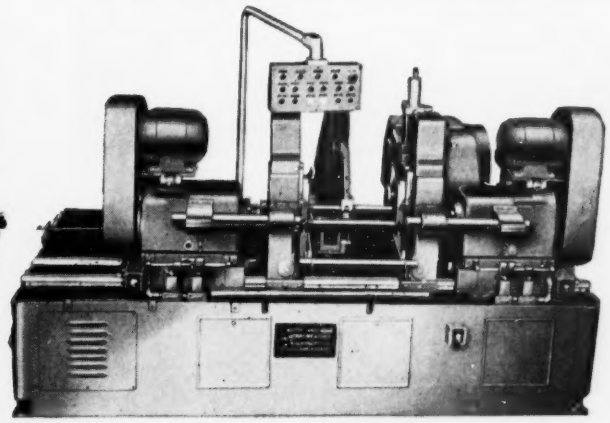
Milling and center drilling unitized. Face mills and center drills both ends of pinion shaft. Up to 230 shafts per hour.

Weight-balance milling machine unitizes weighing and subsequent metal removal. Face mills weight boss on each end of automotive connecting rod. Up to 300 pieces per hour.

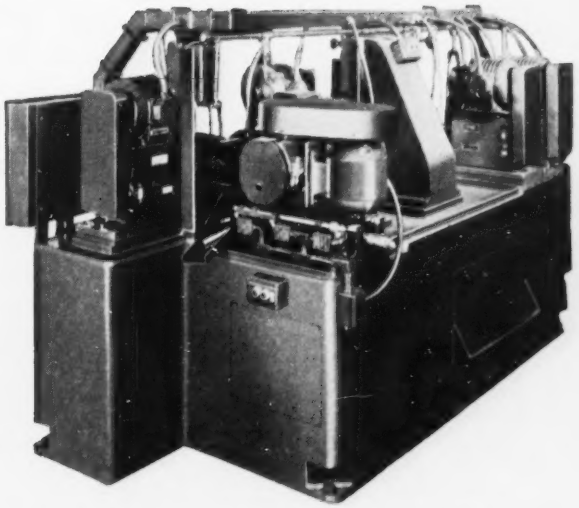


M. & M. TRANSFER MACHINES

for bar stock cut-off and double-end machining, tailored for individual requirements.



Cut-off operation simultaneous with double-end machining. Models for stock ½" through 6" diameter, lengths 8" through 40". Many forms and combinations of double-end machining.



Unusual combination of machining operations in one unit: drill, countersink, broach, cut-off, chamfer.

Manufactured by — THE MOTCH & MERRYWEATHER MACHINERY CO. —
CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

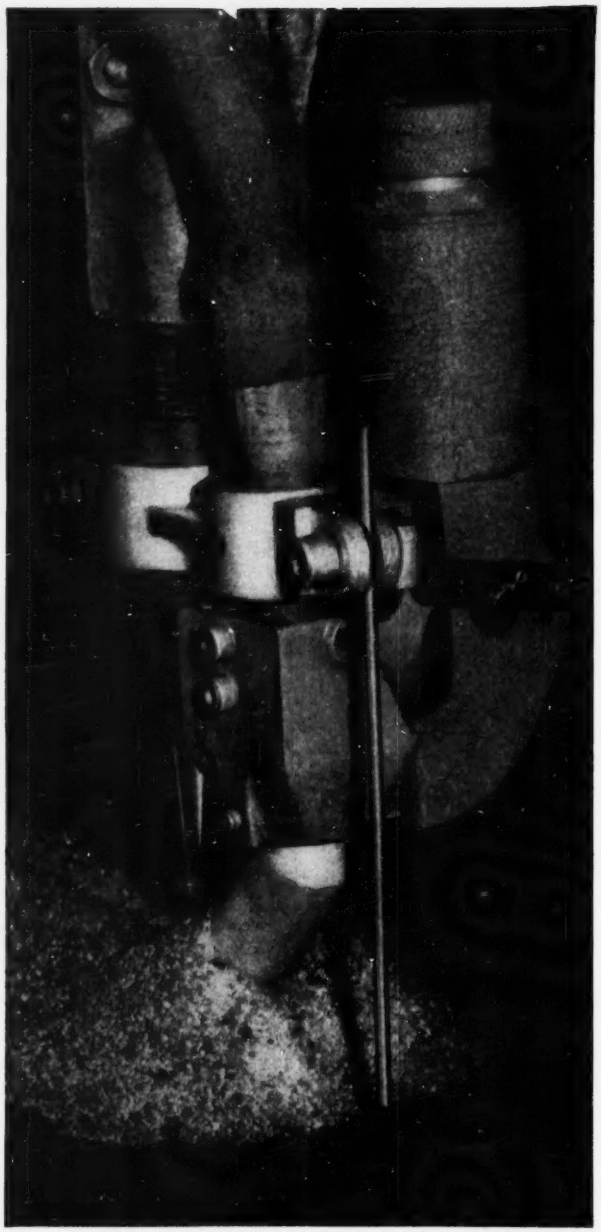
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Two important parts of

UNIONMELT WELDING

Trade-Mark

You Can't See



This is UNIONMELT welding—instantly recognized by the special granulated material you see blanketing the weld. *You can't see* the powerful electric arc that fuses the metal beneath at the highest production rate attainable. No sparks or glare disrupt nearby plant activity.

You can't see the LINDE SERVICE that stands behind every UNIONMELT installation to assure its efficient and profitable operation. Only LINDE can give you this unique combination of research, engineering, and over 40 years of welding know-how that is helping LINDE customers save money and improve production. And only LINDE can give you the accumulated benefits of more than 18 continuous years of development, field testing, and improvement in the field of submerged melt welding where it pioneered.

LINDE's Service Engineers will gladly help you design a UNIONMELT installation to meet your exact requirements. They will also be available to help you when a tough production problem comes up. Call your nearest LINDE representative today.

Linde
TRADE-MARK

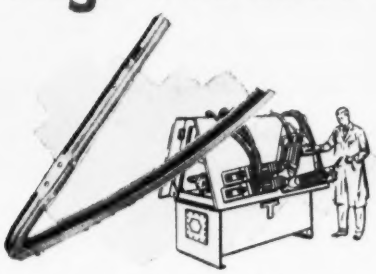
LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

The terms "Linde" and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.

For more information on products advertised, use Inquiry Card, page 261

There are lots of ways to PIERCE METALS

But here's High Production Piercing in a single set-up

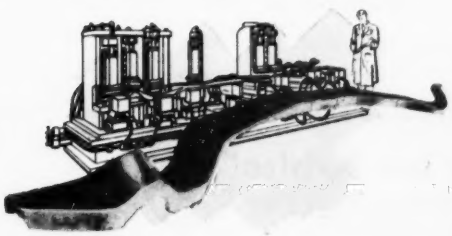


Seven irregular holes and two trimming operations complete this car door inner window frame in one setup. Model changes can be made at low cost.

DANLY HYDRAULIC METALWORKING EQUIPMENT

Now you can pierce multiple holes of practically any type—round, oblong or irregular—to very close tolerances in a single setup. Capacity of Danly Metalworking Equipment can be as high as 225 tons per hole with break-through shock practically eliminated. Each station hydraulically strips its punch, greatly simplifying fixturing. Custom-built for your piece part, Danly Hydraulic Metalworking Equipment enables you to pierce more holes faster and more accurately—in one operation.
Write for the special bulletin shown at right today.

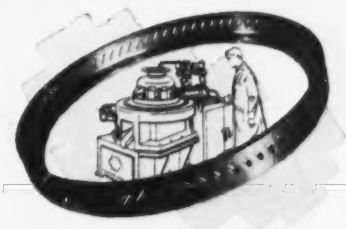
DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois



More than 40 holes in this automotive frame member are pierced simultaneously on a Danly machine built expressly for this purpose.

DANLY

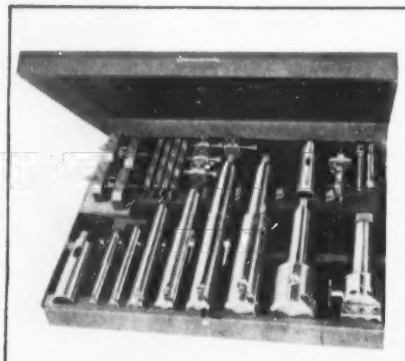
HYDRAULIC METALWORKING EQUIPMENT
MECHANICAL PRESSES
50 TO 3000 TONS



Irregularly shaped holes are pierced in this stainless steel jet engine part to very close tolerances—automatically.

Davis "Super Micrometer" stub boring tool sets give you greater machine use by eliminating cut-and-try boring. They are extremely rugged, adjustable to .0001 in.

With these handy, production-boosting tool sets you have high precision tools for handling heavy boring assignments from ⅜ to 7 in. diameter . . . light, extended boring up to 13 in. diameter.



Set No. 11 (illustrated) contains seven stub boring tools covering a boring range from 1½ to 7 in. It is one of the ten complete, convenient, standard sets for you to choose from.

Modifications in any set can be made to meet your exact requirements.

Available for almost immediate delivery, these sets are all equipped with high-speed steel cutters. Stellite, super-high-speed steel or tungsten-carbide tipped cutters can be furnished upon request. Some sets include offset boring heads, pencil boring heads and reducing sleeves . . . plus setup items such as parallels, adjustable stop jacks and T-slot parallel blocks.

See your representative or write for details.

If Davis can't bore it — it can't be done

Davis Boring Tool Division

GIDDINGS & LEWIS MACHINE TOOL COMPANY

FOND DU LAC, WISCONSIN

Builders of plain and micrometer adjustable block type boring tools; line boring bars; special boring tools; car boring tools; planer, vertical boring and turning mill tools; Quick Change arbors and sleeves.

For more information on products advertised, use Inquiry Card, page 261

SPECIFY CLEVELAND REAMERS

For Smooth Finish and Economy

A *complete* line of Reamers, offering a wide range of types and sizes for every requirement. All are correctly engineered to give you accuracy, efficiency, long life and *more holes per grind.*

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

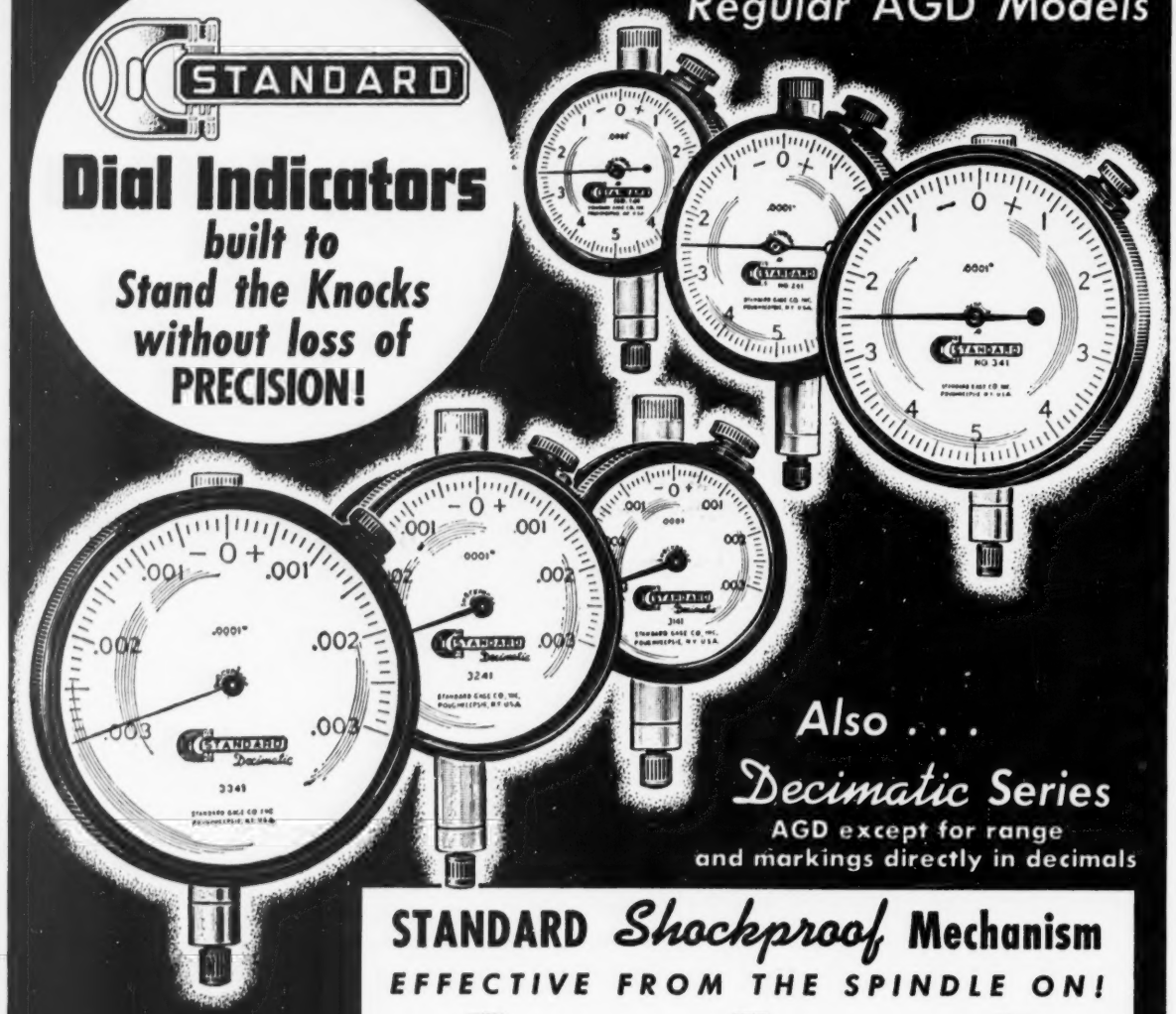
TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

STANDARD

Dial Indicators

built to Stand the Knocks without loss of **PRECISION!**

Regular AGD Models



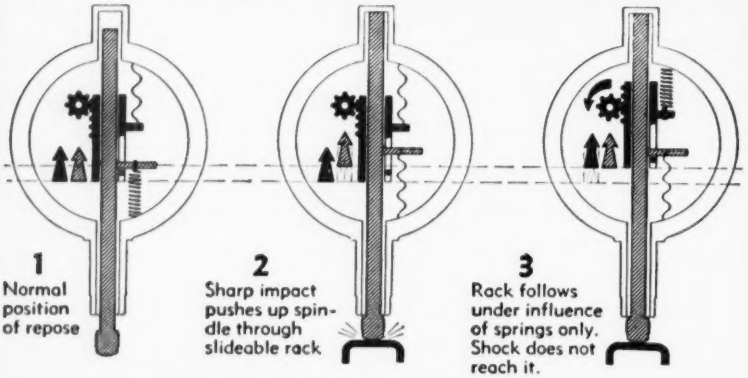
Also . . .

Decimatic Series

AGD except for range and markings directly in decimals

STANDARD *Shockproof* Mechanism

EFFECTIVE FROM THE SPINDLE ON!


1
Normal position of repose
2
Sharp impact pushes up spindle through slideable rack
3
Rack follows under influence of springs only. Shock does not reach it.

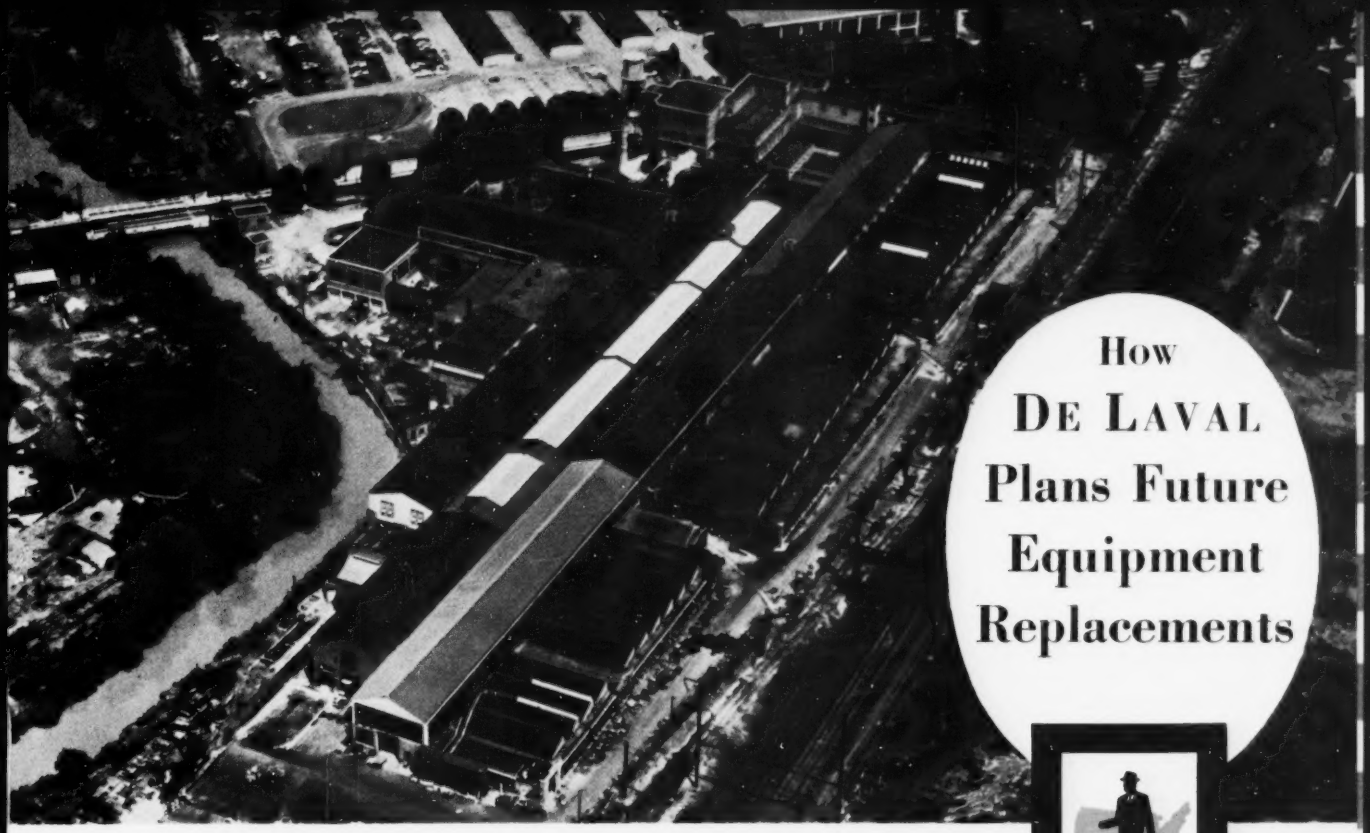
This shockproof mechanism, standard in practically all STANDARD Dial Indicators, protects the delicate gears from impact shocks, often unavoidable. Regardless of degree of impact on the spindle, force on gears is never greater than that caused by contraction of upper spring. Just one of many reasons for STANDARD'S superiority in precision—performance, service life and economy.

Also Long Range, Long Stem, 90 (stem perpendicular to face), Midget, Extra Large and Quadrant Models and accessories.

Ask for CATALOG C

STANDARD GAGE CO., Inc., *Poughkeepsie, N. Y.*

For more information on products advertised, use Inquiry Card, page 261



How DE LAVAL Plans Future Equipment Replacements

"The De Laval Steam Turbine Company is both a manufacturer and purchaser of capital equipment, manufacturing turbines, blowers, pumps, gears, and Marine equipment. The company sells to every major market across the board of American industry, including municipalities and U. S. Navy. Its purchases are largely from the machine tool and allied industries.

Accurate records are maintained on each piece of equipment from the date of purchase. Recorded also for ready reference is data covering general description, size, capacity, speeds and feeds, horsepower, and other useful information.

In 1945 we established a long range replacement program. Total allowable depreciation does not begin to take care of replacement costs. The balance must, therefore, come from our own profits. Funds must be estimated and planned for in advance. This planning is further refined by a yearly capital appropriation, adjusted as may be necessary for product changes and new developments. Large special equipment is engineered one to two years in advance of its anticipated installation and the plant Engineering Department are now engineering and planning for purchases due for installation in 1954.

This program has resulted in the installation of several million dollars of equipment since its inception. The benefits which we have obtained from it are reduced cost, improved quality and additional factory space where a new machine may replace two or more obsolete machines. Operating management has had the complete support of the stockholders in this aggressive replacement program."

C. A. JURGENSEN
Vice-President in Charge of Manufacturing
De Laval Steam Turbine Company, Trenton, N.J.

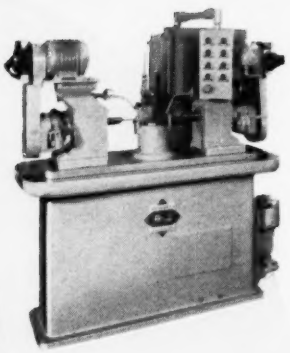
ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When The Time For Replacement Arrives . . . . . .

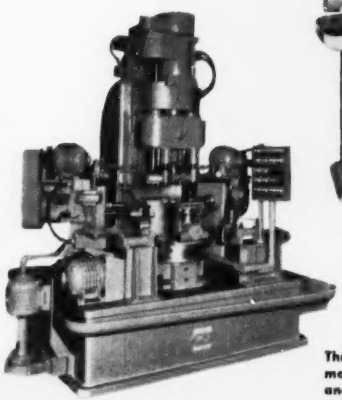
Rehnberg-Jacobson

SPECIAL MACHINES FOR COMBINING OPERATIONS

The principal advantage of R-J machines is the fact that they can be made up in so many different ways — to handle an almost infinite variety of combinations of machining operations. The pictures here, for example, show five machines that were designed and built to produce certain parts for an automatic transmission. In each instance a number of standard operations have been *combined* by means of an ingenious arrangement of R-J Drill, Tap, and Index Units on a simple structure. The variety of operations performed on each machine is shown in the caption which accompanies each picture. These machines not only do a good job of producing, but they also have a *high salvage value* when the inevitable model change comes along — because the standardized Units can be retooled and rearranged with minimum difficulty. Let us make suggestions for solving your next machining problem.

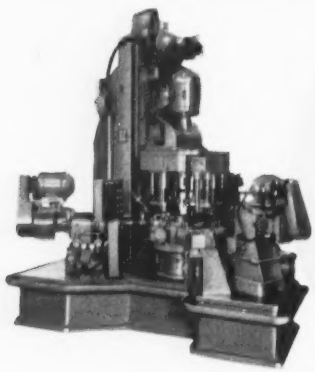


Horizontal two-spindle machine that combination drills and countersinks two opposed holes in a Reverse Planet Pinion Carrier.



Three-station multiple-spindle machine that drills, reams, and taps miscellaneous holes in a Rear Oil Pump Housing.

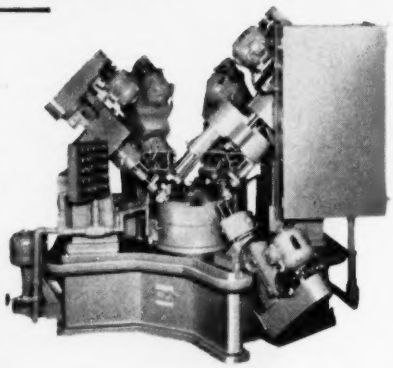
PRODUCING VARIOUS TRANSMISSION PARTS



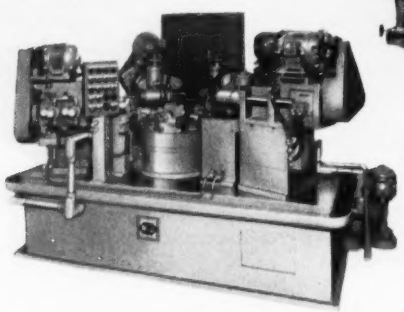
Six-station multiple-spindle machine that drills, bores, chamfers, and taps the same Kickdown Band Lever as is further processed on the machine at the right.

ALL-MECHANICAL UNITS

R-J Units used on production machines are *completely mechanical* in operation. Reports from users indicate that, because of this, the functioning of each Unit is *easily understood* by the operators and maintenance men who work on the machines — and that this understandability leads to an improvement in production efficiency.



Six-station machine that drills, countersinks, and reams the center hole and cross holes in a Planet Pinion Shaft. Each fixture carries two pieces.



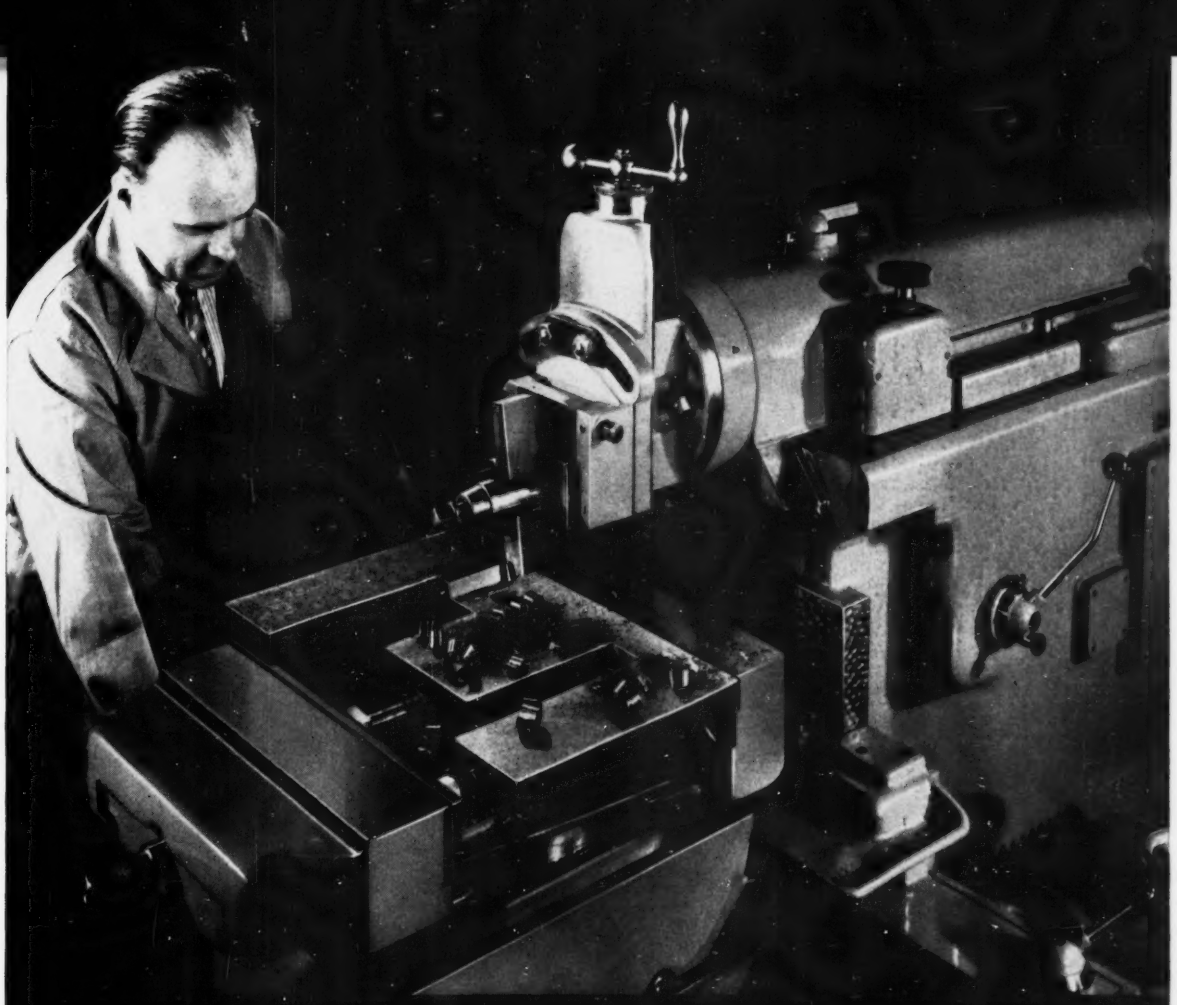
Five-station horizontal machine that countersinks, spot faces, and mills a Kickdown Band Lever.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MADE IN ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP
ILLINOIS, U.S.A.



INCREASE YOUR OPERATING EFFICIENCY...
with ROCKFORD HYDRAULIC SHAPERS

Hydraulic drive permits you to change stroke lengths instantly, even while the shaper ram is in motion. It also gives you a wide range of cutting speeds and feeds, infinitely adjustable.

With flame-hardened and ground ram ways, Rockford Shapers assure long life and constant accuracy for maximum operating efficiency.

Ask a Rockford Machine Tool Co. representative to show you how you can increase your operating efficiency with Rockford Hydraulic Shapers.

528

Hy-Draulic

ROCKFORD MACHINE TOOL CO.
2500 Kishwaukee Street • Rockford, Illinois

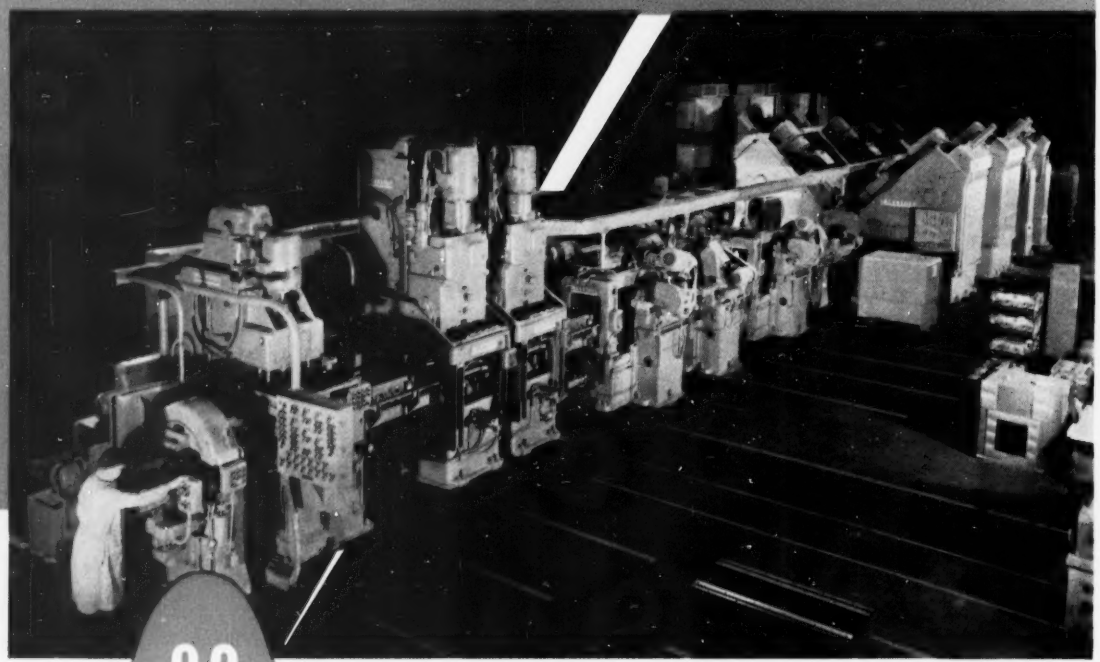
MADE IN
FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD
ILLINOIS, U.S.A.

Machinery, November, 1953

INGERSOLL

EQUIPMENT FOR THE AUTOMOBILE INDUSTRY

High-production process machines and specially designed general purpose milling and boring equipment built by Ingersoll for the automobile industry are typical applications of Ingersoll engineering to specific production problems. Most of this equipment involves exceptionally large investments, for which a sound economic basis is provided by Ingersoll guarantees of production and accuracy. The wide variety of equipment we build for customers in many other industries is likewise engineered to fit the job, with Ingersoll accepting responsibility for performance.

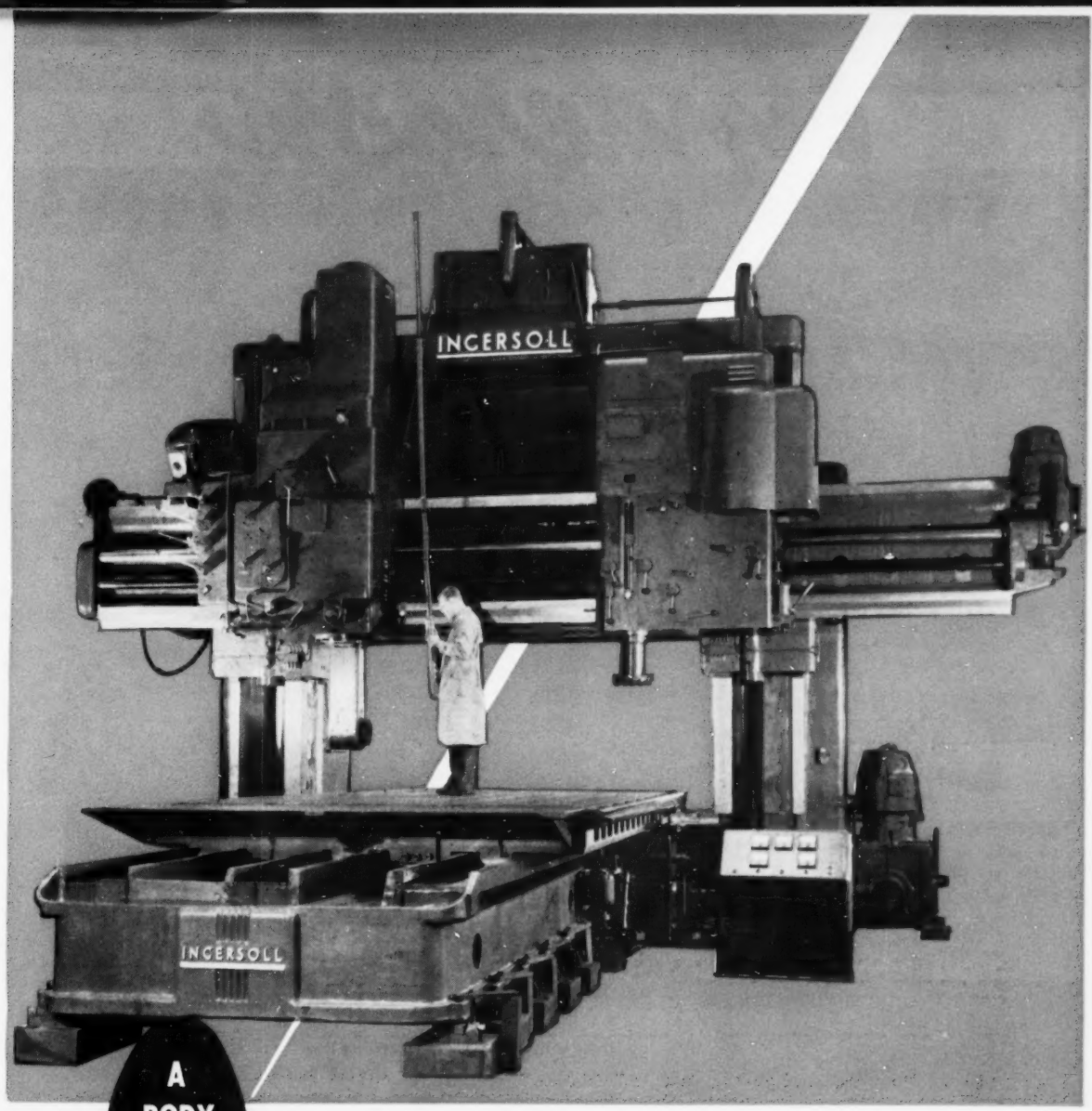


90 CYLINDER BLOCKS IN 1 HOUR

At the push of a button, this 19-station Ingersoll process machine performs a series of milling, boring, drilling, and chamfering operations on V-8 automobile cylinder blocks. One man is able to operate the entire machine because transfer, clamping, and tool feed are entirely automatic. In traveling the 73-foot length of the machine, the blocks are automatically turned three times.

MADE IN ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS

ILLINOIS, U.S.A.



A BODY DIE IN 1 WEEK

Three electronic feed boxes and an 11″-square ram with 360° of angular adjustment are among unusual features of this 186-ton special design Ingersoll Adjustable Rail Milling Machine which contribute to its efficiency in the die milling work of an automobile manufacturer. It is used for face-milling, rough-contouring and other operations on large roof, door, and quarter-panel dies.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... **ROCKFORD**
ILLINOIS, U.S.A.

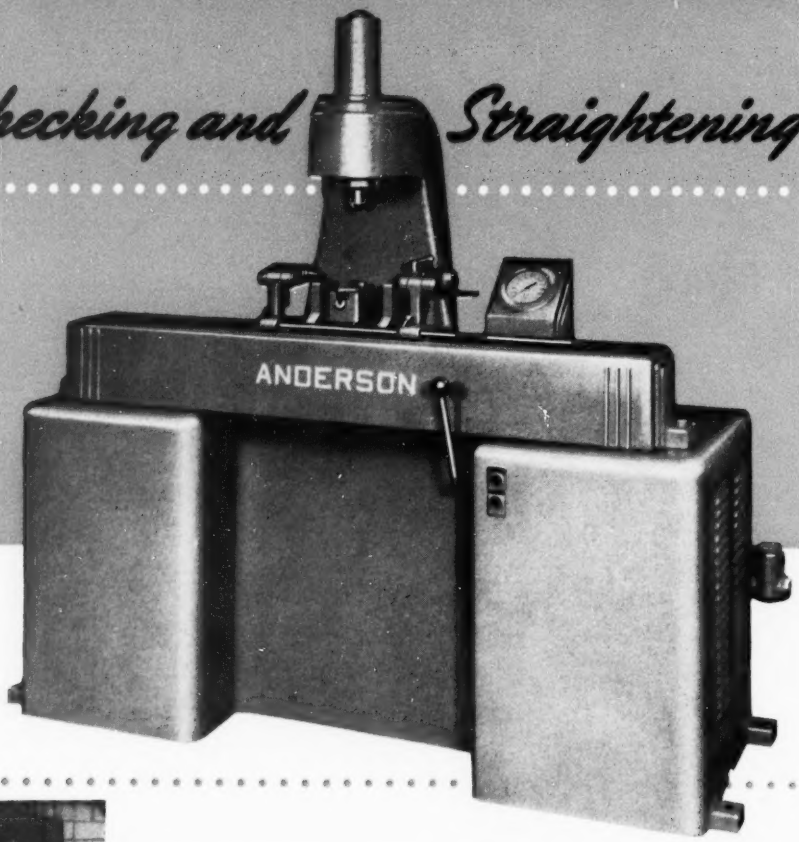
MADE IN

Machinery, November, 1953

Anderson

HYDRAULIC POWER PRESSES

for Faster Checking and Straightening



Built with Stationary or Traveling Ram . . . capacities from 10 to 50 tons . . . so sensitive and accurate that a shaft may be bent .001". Pressure gauge, indicating ram loading . . . adjustable dial indicator shows amount of shaft run-out in preloaded, fully loaded, and unloading positions.

Flexible, sensitive control by rotary control valve operated by hand lever. An infinite range of loading up to capacity as lever is moved from 0 to maximum displacement. Push button control of hydraulic unit. Work table, 60" or 108" long. Available attachments include checking rolls, spring loaded centers, adjustable anvils and indicator. To increase production speed, an adjustable stop collar limits the stroke of the ram.

ROCKFORD Anderson BROS. MFG. CO. ILLINOIS

SEND FOR BULLETIN No. 1-6

Complete Information on Both Stationary and Traveling Ram Types of Presses

ANDERSON BROS. MFG. CO., ROCKFORD, ILL.

MADE IN ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP

ILLINOIS, U.S.A.

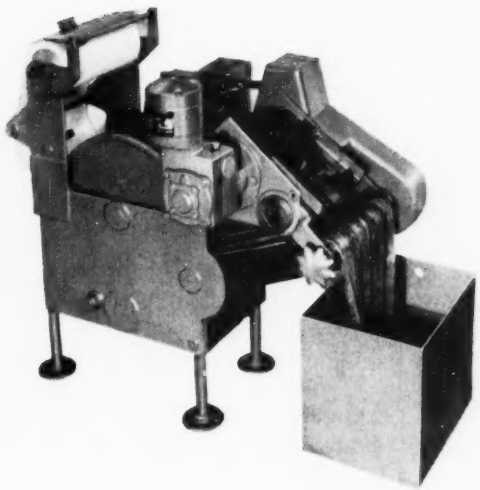
Machinery, November, 1953

Remove **BOTH**

MAGNETIC
AND
NON-MAGNETIC
PARTICLES!
FROM METAL CUTTING FLUIDS

WITH

New
BARNESDRIL
KLEENAL MAGNETIC FILTER

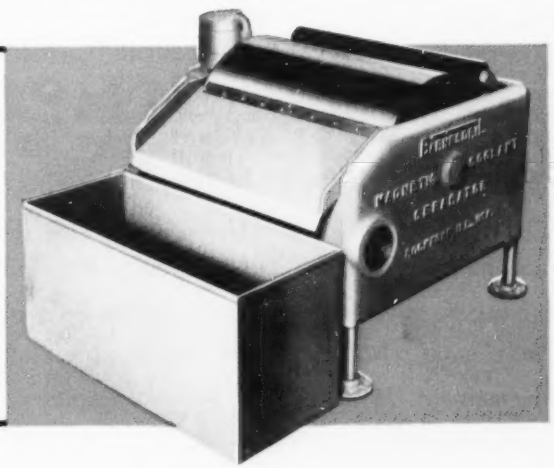


- ★ Remove Metallic Sludge and Abrasives
- ★ Economical, Automatic Operation
- ★ Rapid, Double Cleaning Action

You can now obtain all the benefits of **BARNESDRIL** Automatic Magnetic Coolant Separation, *plus* the added efficiency of removing non-ferrous material. Ask your **BARNESDRIL** representative for complete data

Cleaner Coolants

Efficient **BARNESDRIL** Automatic Magnetic Coolant Separators sharply reduce machine maintenance and downtime, increase finish quality, and prolong coolant life. New **BARNESDRIL** developments offer even greater improvements in coolant supply and chip disposal. Write for Bulletin B3005.



HOLE **BARNESDRIL** FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

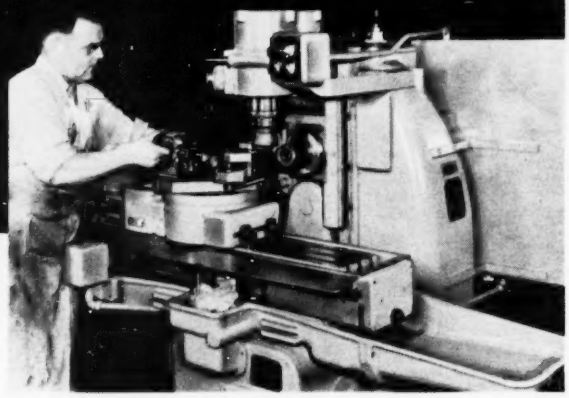
ROCKFORD MADE MEANS PRECISION MADE...

MADE IN ROCKFORD
ILLINOIS, U.S.A.

Here's what can be done with Standard Rigidmils...

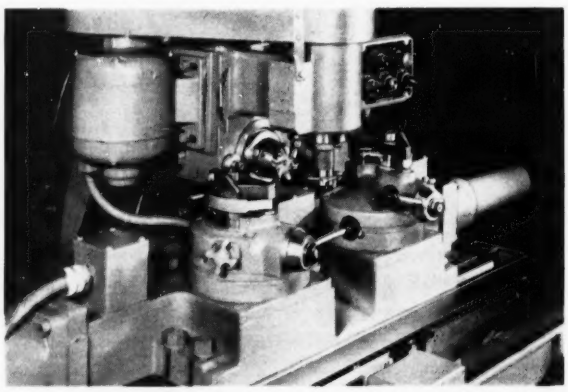
TO SOLVE SPECIAL MILLING PROBLEMS

On standard Sundstrand Rigidmils, the head is a self-contained unit which can easily be replaced with a special head. Consequently, when production or work requirements permit machining several surfaces simultaneously, the standard head can be replaced with a special head, and a *special* job done with the lowest possible capital investment. Furthermore, putting into effect product changes (a difficult problem for many production engineers) doesn't worry anybody in plants where Rigidmils are installed. As these machines can be converted so readily to meet production changes, they represent a combination of maximum production with minimum capital investment. Here are six good examples of standard Rigidmils "engineered" to a production job with "only the head as special".



Special 2-Spindle Head Mills Top and Side of Part Simultaneously

This standard Sundstrand Rigidmil has a special head with one vertical and one horizontal spindle for milling two surfaces of refrigerator cylinders in one automatic cycle. Additional production is obtained by the two indexing fixtures, which permit loading of one part during the milling of another. Production is 150 parts per hour.



Face Milling and Slotting With Special 2-Spindle Head

This Sundstrand Rigidmil is provided with a special high speed head equipped with one vertical and one horizontal spindle. Each spindle has endwise adjustment, and horizontal spindle is provided with automatic retraction. Two power-operated rotary tables are timed and interlocked with the automatic table cycle for rotary milling of the face and slot in washing machine brake shoes. Manually clamped fixtures hold the part for a cycle of load and unload at one end while milling at opposite end. Production is approximately 145 per hour.

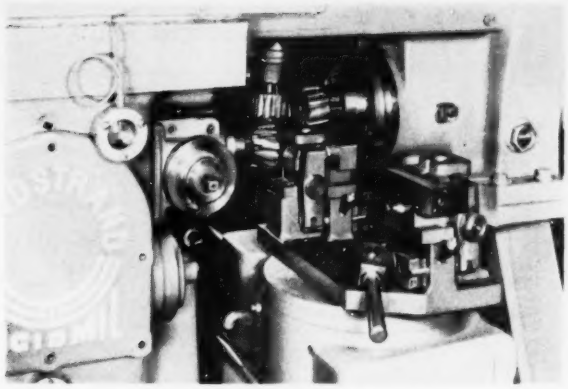
SUNDSTRAND

RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

MADE IN

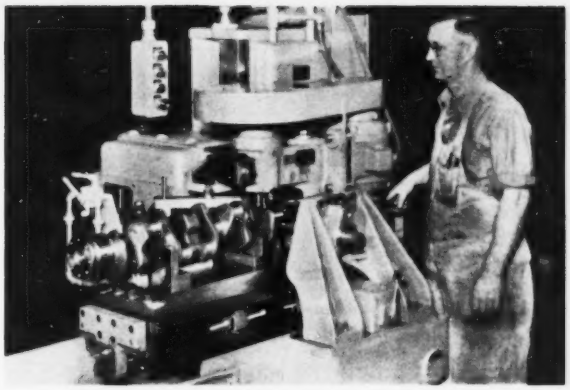
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS

ILLINOIS, U.S.A.



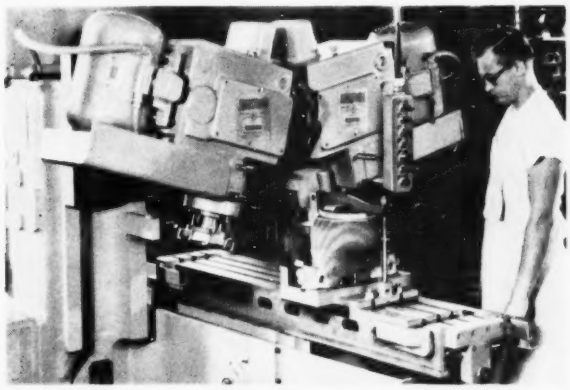
Three Sides of Part Milled Simultaneously With Special 3-Spindle Head

The standard Rigidmil above has a special head with one vertical spindle and two opposed horizontal spindles offset vertically. The top and both sides are milled in one automatic cycle. Not only are operations saved, but the three surfaces are held in accurate relation to each other. Again, automatic indexing of fixtures provides free loading time and helps obtain the production of 172 pieces per hour.



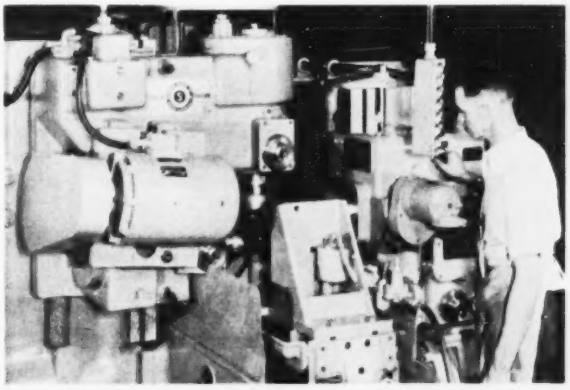
Straight and Woodruff Keyways Milled With Special 2-Spindle Head

Here's a standard Sundstrand Rigidmil "tooled" for a special keyway milling job. It is provided with a regular horizontal spindle head for milling a straight keyway and an attached pivoting head for milling a Woodruff keyway. Both keyways are located in one end of the crankshaft and both are milled simultaneously. Keyways are held in definite relation to each other by milling both in same setting of crankshaft.



Duplex Rigidmil Has Two Special Heads for Angular Milling Operations

This Sundstrand Duplex Rigidmil is equipped with two special heads for angular milling on aircraft cylinder heads. With workpiece inverted in fixture, the milling heads, one set at 10° and the other set at 15°, mill both rocker bosses simultaneously. The machine operating in automatic table cycle of rapid approach, feed and rapid return completes 64 cylinder heads per hour.

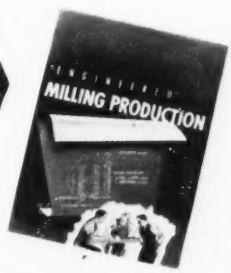


Duplex With One Special 2-Spindle Head Mills 3 Surfaces Simultaneously

A special two-spindle head is mounted on the left hand column of this standard Sundstrand Duplex Rigidmil. One is a vertical spindle and the other is set at 5° from horizontal. The right hand column carries a standard horizontal head. Pads on both sides and top of transmission cases are milled in automatic cycle at the rate of 67 pieces per hour.

Free Data

Write for more proof of the successful application of Sundstrand "Engineered" milling production. This new 40 page book contains over 35 actual problem solutions together with interesting tooling diagrams. Write for your copy today. Ask for Bulletin No. 628.



SUNDSTRAND

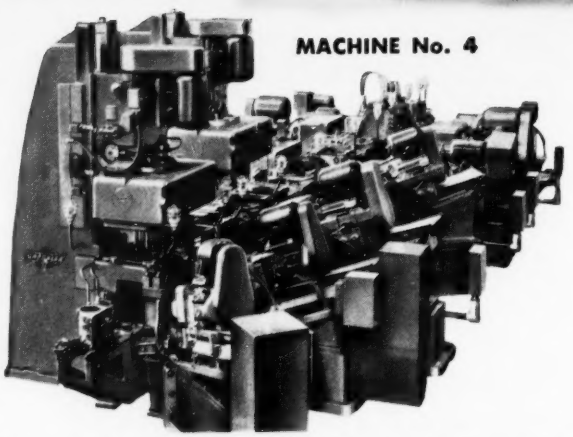
SUNDSTRAND
Machine Tool Company
2530 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

MADE IN
CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD
ILLINOIS, U.S.A.

208 OPERATIONS IN 44.3 SECONDS

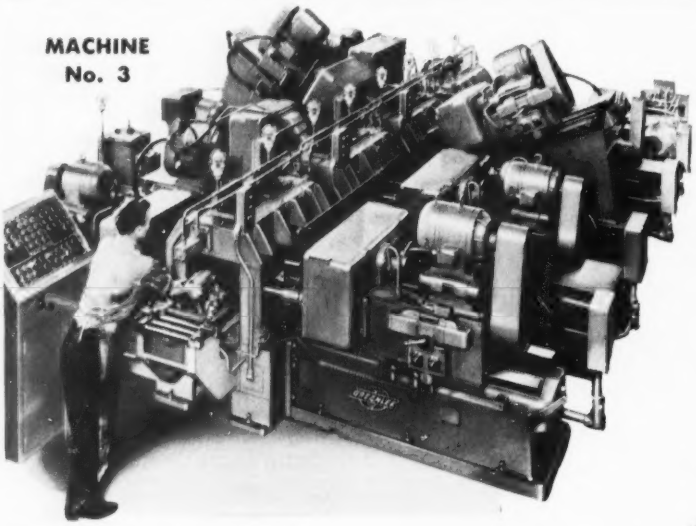
These recently-built Greenlee transfer machines mill, bore, drill, ream, and tap transmission cases for a well-known automobile. A total of 183 tools complete 208 operations in an automatic cycle time of 44.3 seconds. Features include face and end-milling heads, turnover and chip-cleanout stations, and indicator lights for tool changing. Self-contained hydraulic units conform to JIC standards for easy maintenance. These outstanding machines are among the newest built by Greenlee — a pioneer in progressive transfer-machine principles.



MACHINE No. 4

GREENLEE

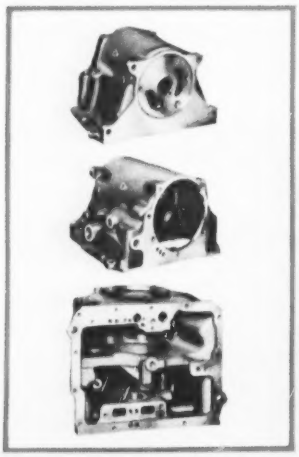
MACHINE No. 3

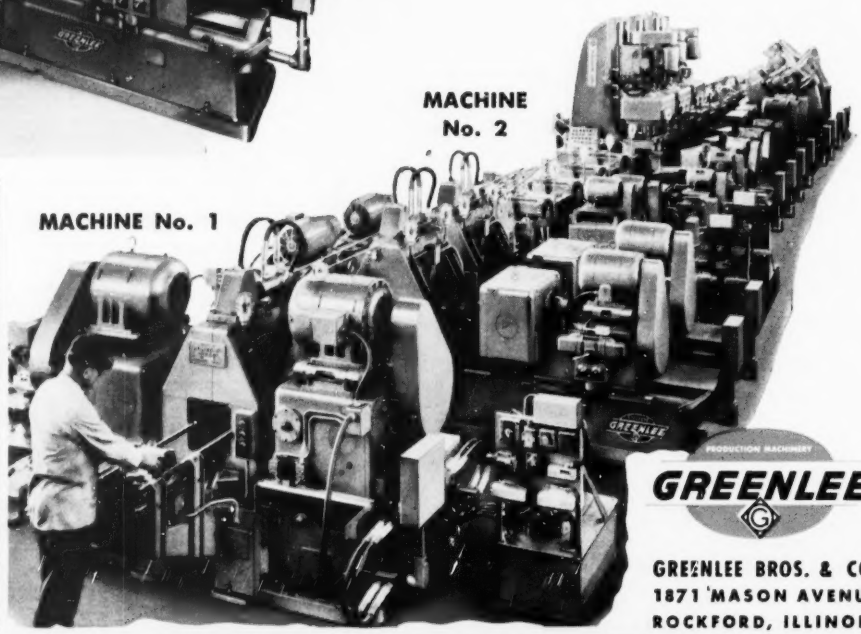


TRANSFER MACHINES
PROCESS
AUTOMATIC
TRANSMISSION CASES
AT THE PRODUCTION RATE OF
65 CASES PER HOUR

MACHINE No. 2

MACHINE No. 1





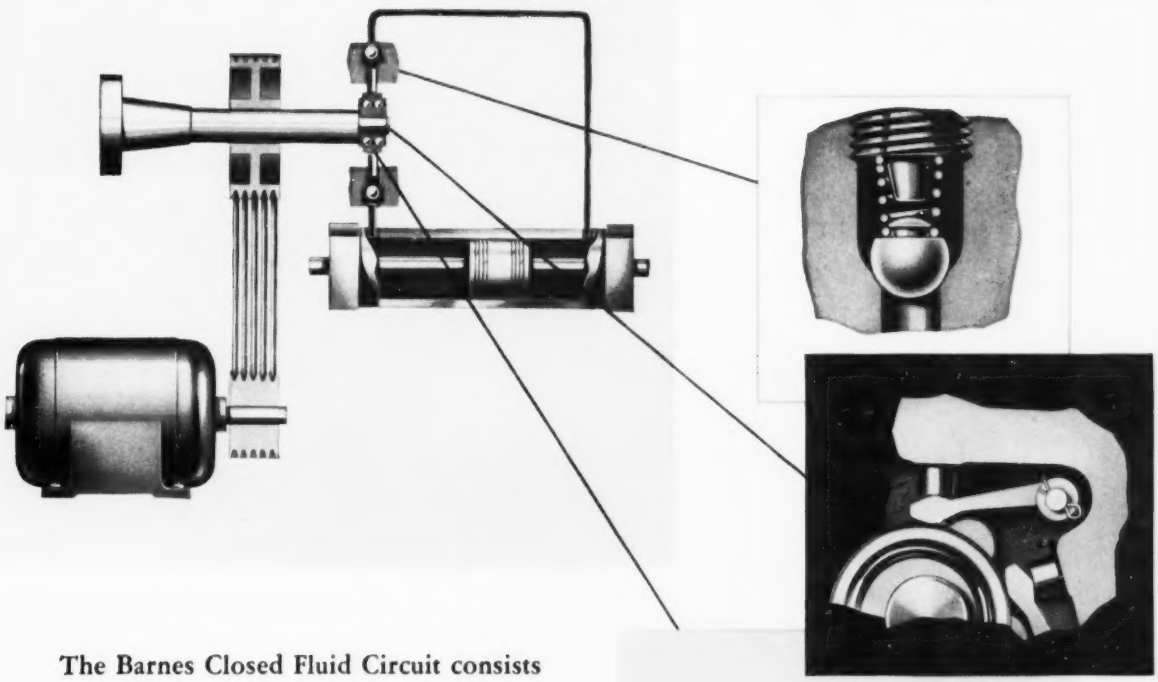
GREENLEE BROS. & CO.
1871 MASON AVENUE
ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

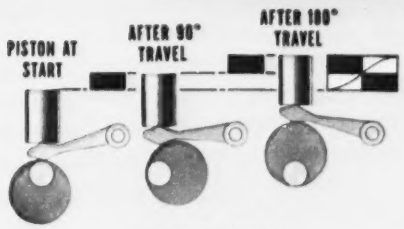
MADE IN
ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS
ILLINOIS, U.S.A.

alone

BARNES closed fluid circuit and drive



The Barnes Closed Fluid Circuit consists of a rotary supporting means; a variable displacement pumping arrangement synchronously driven from the rotary means; and a driving arrangement, including means for connecting and disconnecting the rotation of the rotary means, which causes the displacement pump to operate automatically and synchronously with the rotary supporting means.



SYMMETRICAL ACTION OF PUMP PISTONS

BRANCH OFFICES

503 New Center Building
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Chicago 13, Illinois

132 East Hanover Street
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1012 Empire Building
Pittsburgh 22, Pennsylvania

B. W. Rogers Company
850 South High Street
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Standard Machine & Tool Co.
870 Ottawa Street
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3931 W. Slawson Ave.
Los Angeles 43, California

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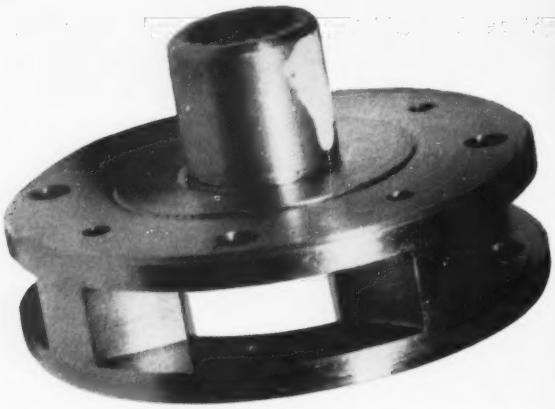
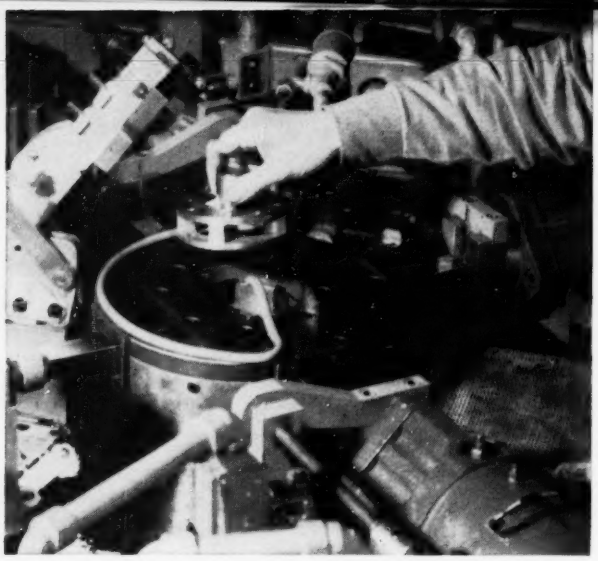
JOHN S. BARNES CORPORATION • ROCKFORD, ILLINOIS

FOR METAL REMOVAL WITH ACCURACY AND SPEED...

MADE IN ROCKFORD ILLINOIS, U.S.A.



This is an automotive turbine part. In producing the piece it was found that after milling, one-eighth inch of stock needed to be removed from each end of the four pinion slots in the part (the stock to be removed is shown by the colored area).



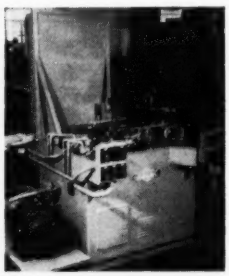
This close-up shows how American engineers attacked the broaching problem. With high production as their goal they devised a machine that would allow all 4 pinion slots to be broached by four radially located reciprocating rams operating in sequence on one fixture.

Special *American* machine helps solve broaching production problem

In nearly every manufacturing operation, sooner or later a metal removing problem occurs that can be solved economically, only by broaching. Usually operations such as these are on high production runs that demand special machines and special techniques. Conventional methods could have been used to remove the small amount of metal required on these automotive turbine parts. But — conventional methods would have greatly reduced production and increased overall time and costs.

American designed a special 4-ton machine to broach the four radial holes of the turbine parts with push broaches. The part is loaded, automatically clamped into place, and then each of the four radially located reciprocating rams working in sequence, push the broaches through the pinion slots and finish the pocket edges. At 100% efficiency the machine can turn out 300 pieces per hour.

Many times production problems such as this one do not require a special machine —but can be handled quite efficiently on a standard American machine. Adapting your problems to American machines is simple work for our engineers. Send us a part-print or sample and your hourly requirements. We'll give you our recommendations with absolutely no obligation on your part.



This is the special machine built by American to solve this broaching problem. We can help you, too. Write us today for information on your particular problem or send for Catalog 300. It illustrates and describes standard American machines.

AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

MADE IN ROCKFORD...FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

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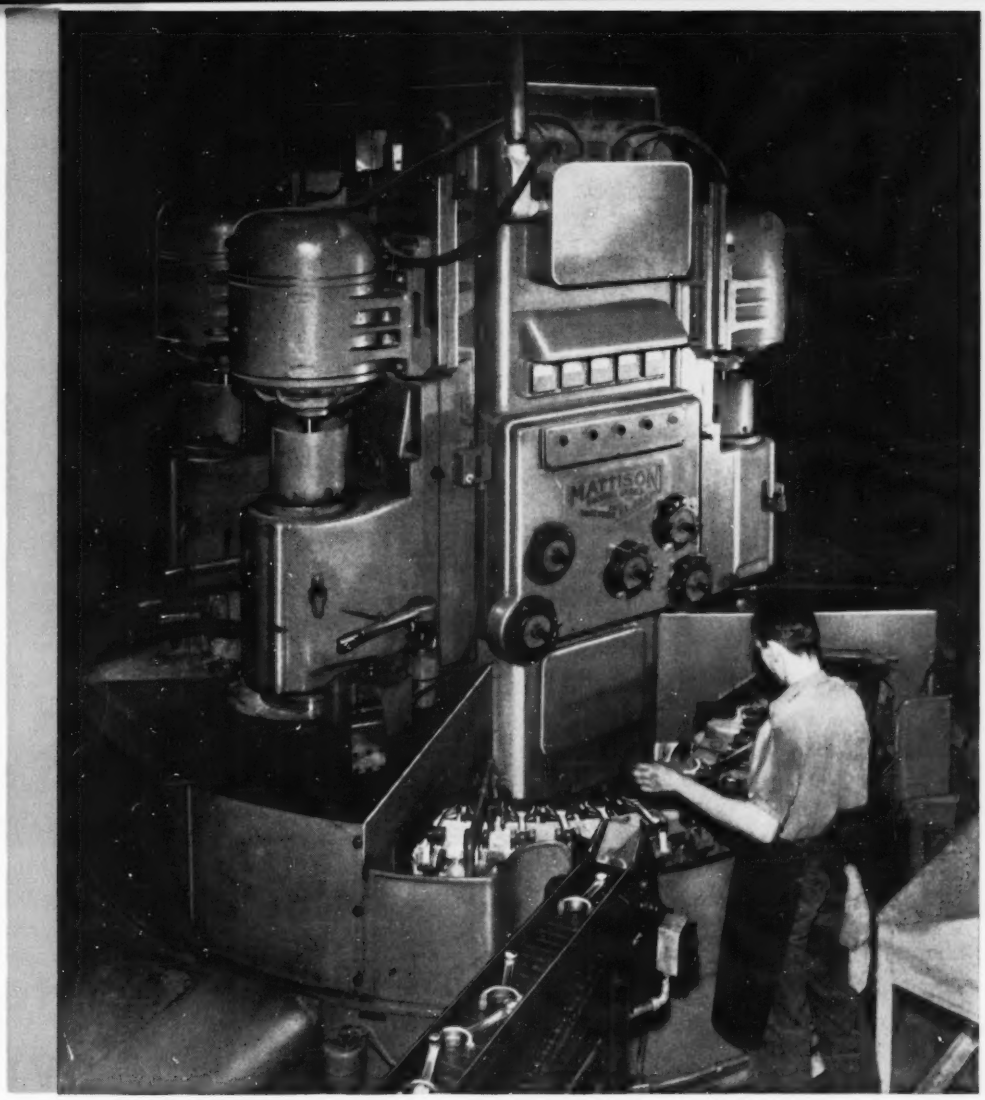


● At the Cleveland Engine Plant of the Ford Motor Company, both sides of wrist-pin and crank-pin bosses are accurately ground on a high production basis with this five wheel Mattison (Hanchett-Type) Vertical-Spindle Automatic Rotary Surface Grinder. Work pieces are held in automatic clamping fixtures. Automatic sizers are constantly in operation checking the work and keeping all pieces within specified tolerances without operator's attention.

This is only one of the many grinders made by Mattison. Whatever your surface grinding problems may be, write us for our recommendations on the proper method and machine for your job.

MATTISON MACHINE WORKS

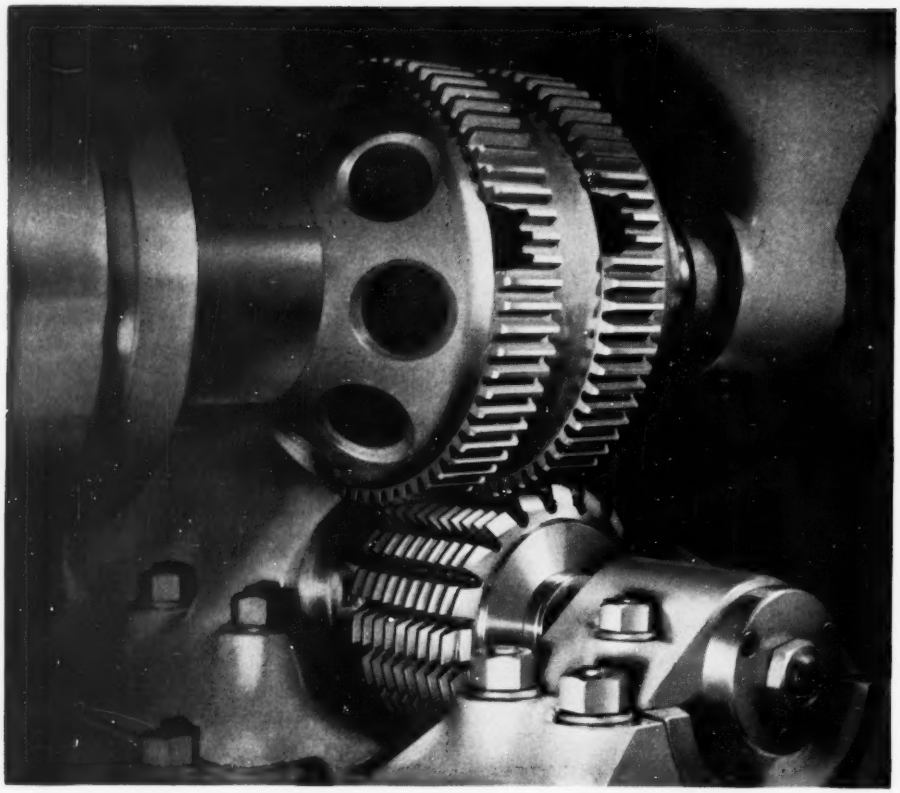
ROCKFORD · ILLINOIS

MADE IN

CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD

ILLINOIS, U.S.A.

Machinery, November, 1953



Hold .002″ Over Pins, One-Cut Hobbing

ON NO. 14-15 MACHINE

Where heavy production and extreme accuracy are required, the No. 14-15 Hobbing Machine offers wide work range with extremely easy set-up and operation. Automatic cycling with infinite hydraulic feeds assures consistently high output.

On the job shown here, Caterpillar Tractor Co. is finish hobbing 8 pitch, 10″ diameter clutch gears in 1-cut on a Barber-Colman No. 14-15 Hobbing Machine. Measurement over .250″ pins is held consistently within .002.″

An important production feature of the machine is the built-in differential, standard equipment for convenience in hobbing helical gears. A large 18⅝″ diameter worm gear running in anti-friction bearings also permits high speed precision indexing.

With capacity for one-cut hobbing of gears as coarse as 3½ pitch in steel, the No. 14-15 supplies rigidity and power to meet most any demands for high gear production and accuracy.

BUILDERS OF PRECISION GEAR

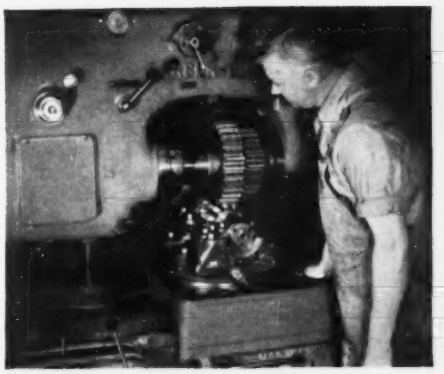
MADE IN

ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT

ILLINOIS, U.S.A.

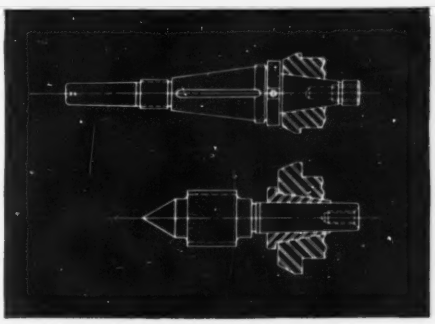
wide variety of work on no. 14-15 machines

In addition to these 8 pitch gears, a variety of high production gear jobs are handled on No. 14-15 machines in the manufacturing department at Caterpillar. The accuracy, versatility and production convenience of the machine make it ideal for heavy accurate gear cutting, typical of tractor production. Shown here is another job, a 3 pitch cluster gear with 10.333" outside diameter, hobbed in two cuts to pre-shave limits, one per load, holding .006" over .5760" pins.



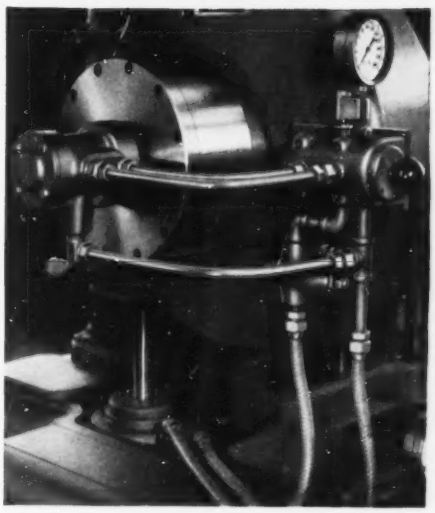
interchangeable hob spindle adds flexibility

The No. 14-15 has an interchangeable shank-type hob spindle as standard equipment. This enables the operator to interchange straight arbor, taper arbor or shank-type hobs to suit a variety of job conditions. Different diameter arbors may also be used. In cases where hob diameters are small and a shank hob is required, shanks may be inserted directly into the spindle.



hydraulic pressure available for tool clamping

Since the machine is an all-hydraulic machine, self-contained hydraulically actuated tooling for work holding is easily adapted. Hydraulically operated collets and chucks may be used as optional equipment when the machine is ordered with a hydraulic cylinder. Use of such equipment greatly reduces handling and loading time, and is particularly convenient where one operator is handling several machines. The hydraulic system of the machine has been constructed in such a way that this cylinder may be ordered and piped in after the machine has been in service.



Complete information on the No. 14-15 Hobbing Machine is available from your Barber-Colman representative; or send us part prints and production requirements, and we will gladly furnish estimates without obligation.

Write Us for a Copy of the New No. 14-15 Hobbing Machine Bulletin.

HOBS • CUTTERS • REAMERS
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HOB SHARPENING MACHINES

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Barber-Colman Company

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FOR METAL REMOVAL WITH ACCURACY AND SPEED...ROCKFORD
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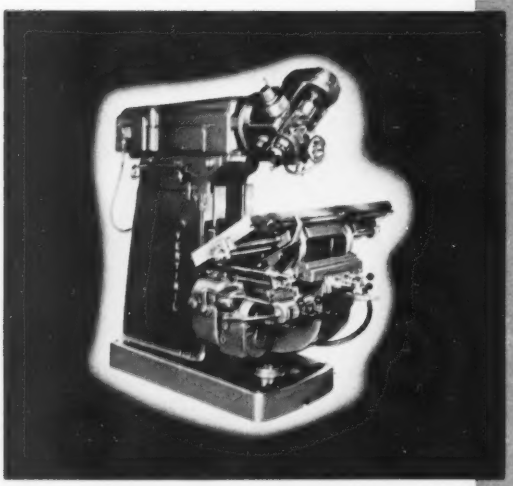
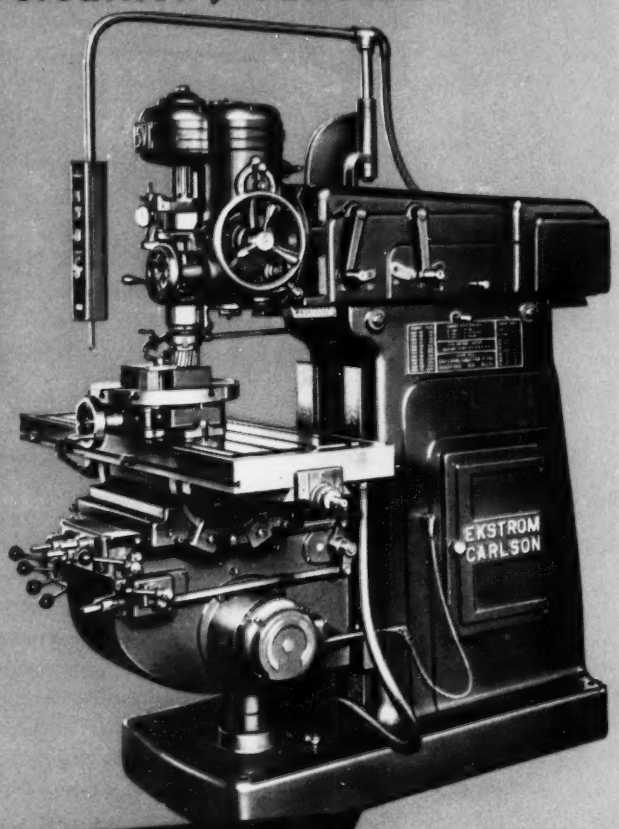
EKSTROM, CARLSON

No. 5V (for "Versatile!") VERTIMIL





POWER CROSS FEED

POWER VERTICAL FEED
(SPINDLE AND KNEE)

POWER LONGITUDINAL FEED

TILTING TABLE

TILTING SPINDLE

IN A CLASS BY ITSELF!

Write for full details Bulletin 5-V

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1400 Railroad Ave.
Dept. M-4
Rockford, Ill.

ECCO

Yes, for all types of toolroom work and many kinds of production work, this machine is *hard to beat!* Ekstrom, Carlson engineers have built into this *one* sturdy machine features which make possible the machining of *compound angles* without shifting the work and without special tooling. The machine also is excellent for precision boring, drilling, and milling.

Rapid traverse, broad spindle speed range, spindle motors up to 25 hp, and centralized controls — all add up to more work at less cost. Investigate today!

MANUFACTURERS OF MACHINERY AND TOOLS SINCE 1904

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ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

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new

LeBLOND

OF CINCINNATI

32"

HEAVY DUTY ENGINE LATHE

WITH

HIGH-POWER

HEADSTOCK

NOW . . . cut with confidence at high horsepower!

New 32" Headstock Designed for Power

Heavy, short shafts minimize deflection.

Hardened and ground gears for all speeds except low back gear.

Finely-pitched wide gears for better tooth action and greater load-carrying ability.

Exceptionally low no-load-friction-horsepower (max. 3.4 hp @ 500 rpm) is proof of highly-efficient design.

Forced-feed lubrication throughout.

36 Spindle Speeds from 5 to 500 rpm

Direct-reading, color-keyed speed change levers.

New High-capacity 4-bearing Spindle

Radial loads @ 100 rpm:

Front Twin Timkens	73,800 lbs.
Center Double-Row Timken .	39,300 lbs.
Rear Ball Bearing	21,850 lbs.

60 hp Motor

EXCLUSIVE! Adjustable accelerations for starting, stopping, jogging

To bring heavy work pieces up to speed safely, torque applied for the first five seconds is adjustable. Any percentage of full torque can be selected for this interval. Similar adjustments can be made for stopping and jogging by means of three rheostatic controls to the electric clutch and electric brake.

Proven in Grueling Field Test

This headstock has been proven in the field on one of the toughest of all lathe jobs—roughing a heavy, out-of-round steel forging. Pulling two carriages, it has been hogging off over 75 cu. in. of metal per min.* The cuts consume a continuous *measured* 50 horsepower. Customer reports complete satisfaction.

*Two tools cutting at an average 1¼" depth at 200 ft. per min. equals 75.9 cu. in. per min.

LeBLOND OF CINCINNATI

4-DIRECTIONAL POWER RAPID TRAVERSE

Built as an integral part of the apron, LeBlond Rapid Traverse adds greatly to ease and speed of operation. A single lever controls movement of carriage in both directions and cross slide in and out.

ONE-PIECE APRON, HARDENED RACK

A rugged one-piece, double-wall casting houses the sturdy shafts and gears and the positive-jaw feed clutch. A single lever controls both cross and length feed. All bearings, cross slide and carriage ways are *lubricated automatically*. The rack is flame hardened.

TOTALLY-ENCLOSED QUICK CHANGE BOX

Sealed in an oil-tight casting and lubricated automatically, this quick-change box requires no operator attention. Steel gears are used throughout and sliding gears are mounted on splined shafts. Forty-eight feeds and threads may be quickly set from the direct-reading plate.

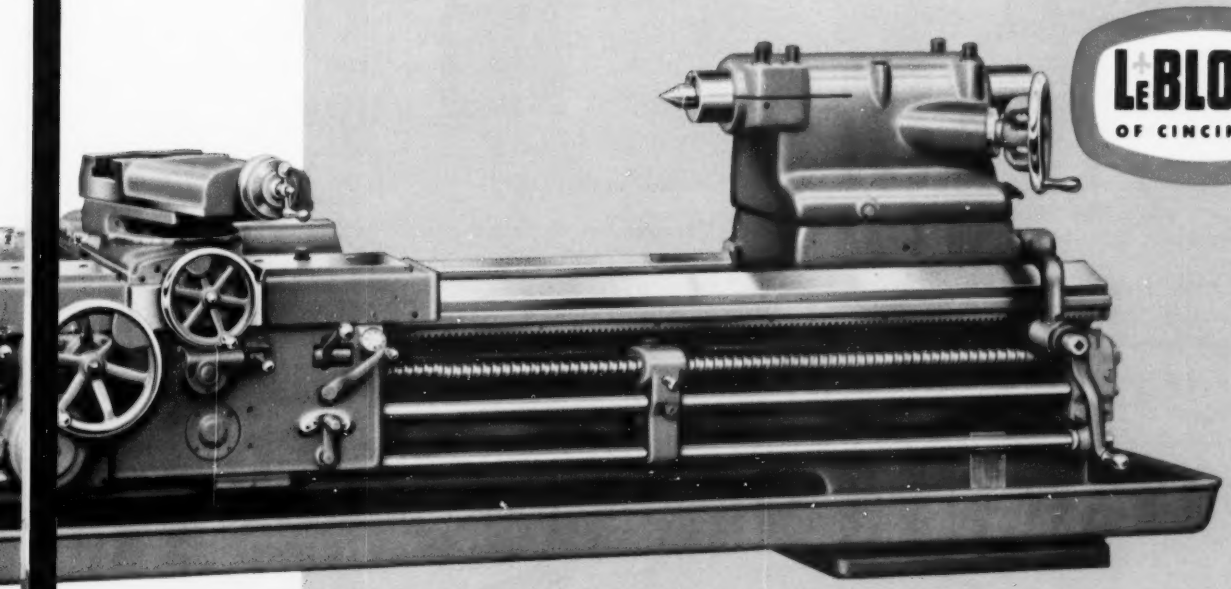
HARDENED AND GROUND STEEL BED WAYS

Of compensating vee-way design, these hardened ways (62-66 Rockwell C, 600 Brinell) are replaceable in the event of accidental damage.

THRUST-LOCK TAILSTOCK

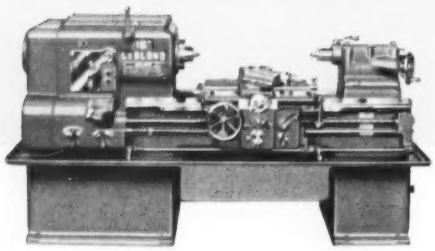
This exclusive LeBlond design, incorporating a worm and rack construction, puts the handwheel at a convenient angle to the operator, provides positive safety lock against thrust and exceptionally long travel. Full-length support when spindle is extended.

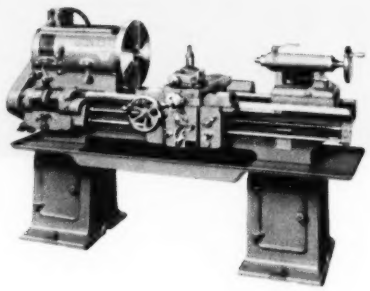
Write today for Bulletin HD-164.



LeBLOND
OF CINCINNATI

SELECT YOUR LATHES FROM LEBLOND'S 76 MODELS





HEAVY-DUTY ENGINE AND TOOLROOM

Free-running spur-gear headstock, 3 and 4-bearing spindles, totally-enclosed quick change box, one-piece apron, thrust-lock tailstock, hardened and ground replaceable steel ways, 4 and 6-way power rapid traverse on larger models. Swings—12″, 14″, 16″, 20″, 25″, 32″, 40″ and 50″.

REGAL

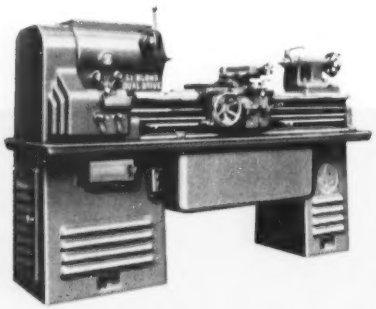
Light-duty lathes with heavy-duty features—ideal for production, job shop work and training. Geared headstock, quick change feed box, separate leadscrew and feed rod, taper key drive spindle nose, one-piece apron. Swings—13″, 15″, 17″, 19″, 21″, 24″, and 13″ bench model. 17″, 19″, 21″, 24″ Gap and 17″/28″ Sliding Bed Gap.

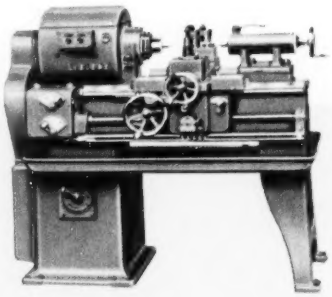
DUAL-DRIVE

15″ swing; twelve speeds, 28 to 1800 rpm; hardened and ground replaceable steel ways; single lever speed control, 96 feeds from .0004″ to .106″; forty-eight threads from 4 to 224; automatic lubrication through headstock and feed box, 3 hp.

RAPID PRODUCTION

Designed *especially* for low-cost high-production turning. *Not* a stripped-down engine lathe. Choice of headstocks gives you speeds within the range *you* choose. Swings—13″, 17″, and 20″.





Crankshaft Lathes—for roughing and finishing all elements of any crank—automatic for mass production. *9 out of 10 crankshaft lathes built today are LeBlond's.*

"Hydra-trace" Duplicating Attachment—for smooth hydraulic tracing of a great variety of contours. Fits any LeBlond built since 1935—except Regals.

Plain and Sliding Bed Gap Lathes—12″, 14″, 16″, 20″, 25″, and 32″; 16″/38″, 25″/50″, 32″/60″.

Hollow Spindle Lathes—16″, 20″, 27″, and 30″.

Contour Facing Lathe—For automatic contour facing of large-diameter work.

Complete line of lathe attachments.

WRITE TODAY FOR CATALOG 53.

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

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OF CINCINNATI

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • FOR MORE THAN 64 YEARS

eliminate the guesswork in selecting tool steels

Thousands of metal working people are using the Crucible Tool Steel Selector to determine exactly which type of steel they need. This handy selector covers 22 tool steels which fit 98% of all tool steel applications.

The selector is unique because it starts with the ultimate use of the steel. It breaks down all tool steel applications into six major classifications, under which the different grades of steel available for certain specific requirements are indicated in legible cutouts. Heat treatment and machinability data are also included for each grade.

A flip of the dial will give you the answer, and almost just as quickly you can get the steel you select. For each type of steel shown on the selector is in stock in Crucible warehouses, conveniently located throughout the country.

To get your Selector merely fill in the coupon and mail. There is no obligation whatsoever.

½ actual size, Selector is in 3 colors

HERE'S AN EXAMPLE:

Application — Deep drawing die for steel

Major Class — Metal Forming — Cold

Sub-Group — Special Purpose

Tool Characteristics — Wear Resistance

Tool Steel — Airdi 150

A turn of the dial does it! And you're sure you're right

Crucible Steel Company of America
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Company _____ Title _____

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Need just a few lengths of seamless brass tube? We'll be glad to hand them to you "over the counter." Or if your job calls for large quantities of brass or copper sheet, rod, wire or tube, we can speed it on its way to you. That's the kind of service you can get by calling your nearest Chase warehouse.

We can supply you with hundreds of items for production, maintenance or repair. That's why it pays to "try Chase first" for anything in brass or copper.

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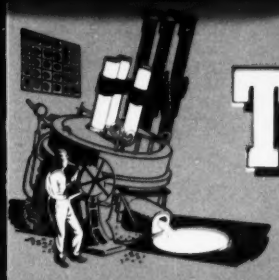
For more information on products advertised, use Inquiry Card, page 261



Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

These Ends are blanked and drawn from 0.053-in. steel or brass on this Lehigh H progressive die. Before Lehigh H was used, the die was redressed almost daily. Now, in addition to providing a better surface on the Ends, the die requires redressing only every sixth week.

This progressive 7-stage die, made entirely of Lehigh H, is used to blank, emboss and form parts for venetian blinds, using 0.032-in. cold rolled steel. The die is hardened to Rockwell C 61.

THREE HIGH-PRODUCTION DIES MADE OF LEHIGH H

Lehigh H is a high-carbon, high-chromium tool steel with characteristics that make it ideal for high-production dies for long-run jobs. Here are the reasons why toolmakers have used it over so many years, with excellent results:

1. Maximum Wear Resistance. Because of its high carbon-chromium content, Lehigh H puts up good resistance to wear. It is the most economical steel for long runs.

2. Close Tolerances. Lehigh H is an air-hardening steel, with only minimum distortion during heat treatment.

3. Safe Hardening. It is cooled in still air from a hardening temperature of 1850° F, and minimizes the cracking hazards of intricate dies, thin sections, and insufficient radii.

4. Severe Service. Lehigh H is a deep-hardening steel, even in large sections, and has high compressive strength.

When three die rings were needed for high-production blanking of covers for large drums for shipping cathode, the manufacturer specified that each ring be held to close tolerances, and after hardening have a Rockwell C hardness of 61 to 63. The rings were made from Lehigh H. Each was given a C scale Rockwell test at four points, with these results: Ring 1: 61, 62, 61, 61; Ring 2: 63, 63, 63, 63; Ring 3: 62, 62, 61, 61.

Peeling Off Ribbons

This chip is curling off the tread of a 33-in. railroad car wheel. The tire-forming tool, nearly hidden at the left, is made of Bethlehem 66 High-Speed Steel, and is used for both roughing and finishing. On untreated wheels these tools average about 45 wheels before regrinding is necessary; on heat treated wheels, they average 16 per grind.

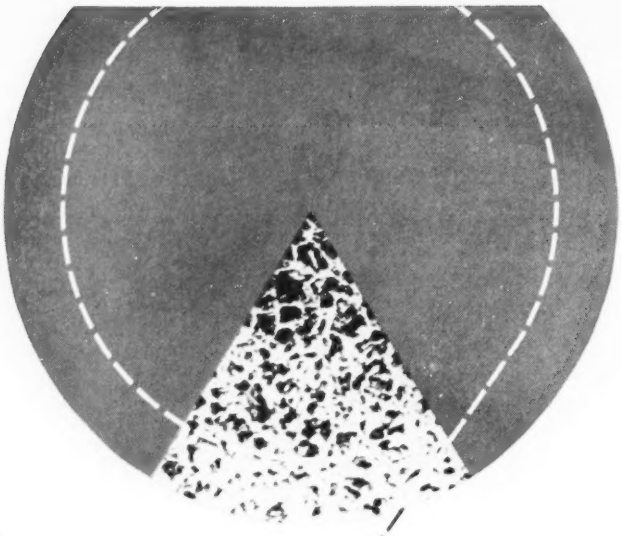
66HS is ideal for a wide variety of cutting tools. It's our M2 grade, containing 6 pct tungsten, 5 pct molybdenum, 4 pct chromium and 2 pct vanadium.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

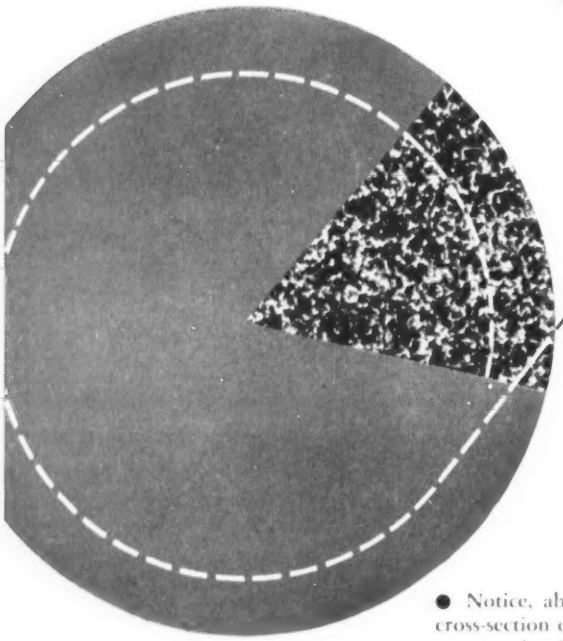
Improper Tool Clearance Reduces Tool Life

In operations such as punching and blanking, the service life of the tool is largely dependent upon the tool clearance. For example, many punch and die sets are made up with a "standard" clearance. But as the proper clearance for punching soft steel is approximately one-tenth of the stock thickness, it is evident that the "standard" clearances are correct for only one stock thickness.

The ideal tool clearance produces flat, sharp punchings with minimum tool load. Excessive clearance produces deformed and burred punchings, and requires high tool loads which shorten tool life. Though insufficient clearance produces flat, sharp punchings, it also requires excessive tool load, and should therefore be avoided. Besides, it increases the danger of damaging the tools because of misalignment.



The "decarb" (light-colored) area in the ordinary heat-treated bar at right must usually be removed before parts can be made from the stock.



Notice that this Republic carbon corrected alloy steel bar has had full carbon content restored to outer edges by carbon correction.

HERE IS WHERE Republic Carbon-Corrected Alloy Steel Bars help you make a profit

● Notice, above at the right, the "decarb" area in the outer edge of the cross-section of a cold drawn alloy steel bar as ordinarily heat treated. Then compare it with the cross-section below at the left. Notice how the carbon has been restored by carbon correction even to the extreme outer circumference.

Here, in the outer rim of Republic Carbon-Corrected Alloy Steel Bars, is the profit-area for your machine tools . . . the part of the bar you don't have to machine away into chips and shavings.

Let our Republic 3-Dimension Metallurgical Service work with your metallurgists and production men to adapt Republic Carbon-Corrected Cold Drawn Alloy Steel Bars to your products. Your Republic Steel salesman can arrange for the Republic Field Metallurgist to call at your convenience.

LAB FIELD MILL

3-DIMENSION Metallurgical Service

. . . combines the extensive experience and coordinated abilities of Republic's *Field*, *Mill* and *Laboratory* Metallurgists with the knowledge and skills of your own engineers. It has helped guide users of Alloy Steels in countless industries to the correct steel and its most efficient usage. IT CAN DO THE SAME FOR YOU.

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

Republic COLD DRAWN
REPUBLIC STEEL
ALLOY STEEL BARS

For more information on products advertised, use Inquiry Card, page 261

Efficient Stripping of Painting Rejects

When the volume of painting rejects slows down your rate of production—as may occur in the manufacture of rigorously-inspected defense equipment—it is time to plan an efficient method for stripping the faulty coatings.

The rejected parts represent a considerable investment in the cost of metal and the cost of fabrication. To hide 5% of your total production in a corner is like hiding 5% of your working capital in a sock. The quicker you reclaim those rejects and push them through as accepted parts, the better profit you make on your contract.

Sometimes the time element dictates more efficient stripping. Suppose that a sub-contractor undertakes to produce 100,000 parts in 20 days. Suppose also that he averages 5% rejects and that he lets them pile up until he has 5,000 to strip and re-process on the 20th day.

On that day he discovers with sorrow that it is a lot harder to strip and repaint 5,000 rejected parts than it was to paint his regular daily quota of 5,000 new parts. He misses his deadline and suffers embarrassment that could have been avoided by stripping 250 rejects each day for 20 days instead of 5,000 in one day.

Don't Take Off Tomorrow What You Can Strip Today

Furthermore, it usually is much easier to strip the parts on the day they are rejected. Even though the parts were thoroughly baked in the ovens, it is still true that the longer the paint ages on the metal the harder it is to remove by any method of stripping.

Another point is that the easy method of dumping the rejects into an out-of-the-way tank for overnight soaking frequently is not the best way to strip the paint. Some paints cannot be removed by immersion in any one stripper, be it alkaline or acid or solvent. Yet many such paints respond quite readily to the right combination of two of these strippers.

Rinse Wisely

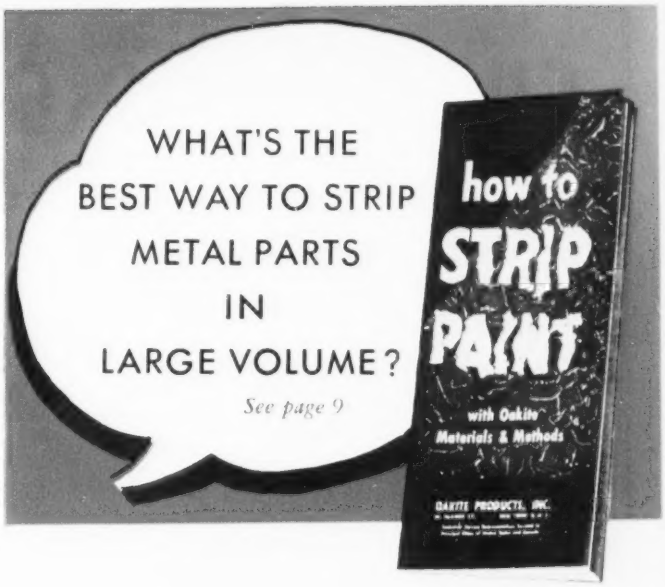
The technique of rinsing is also important. Some paints yield only to a hot alkaline stripper followed by a hot rinse. Sometimes a cold rinse following a hot immersion seems to provide a shock that removes the paint with great speed.

The economy of finding the best stripping method is so great that it merits careful planning. It may also require the advice of a man who has had plenty of experience with all types of stripping operations. Such a man is the Oakite Technical Service Representative in your city.

At the command of the Oakite Representative are more than a dozen stripping materials that reclaim rejects with great speed and effectively strip conveyor chains, racks and hooks. These materials include:

1. Alkaline strippers that remove many types of paints and are also excellent for "killing" the overspray in water-wash paint booths.
2. Solvent strippers that are especially effective on the newer types of synthetic lacquers.
3. A viscous solvent stripper of special value because it adheres to vertical and inverted surfaces.
4. A solvent stripper and an alkaline stripper especially designed for safe removal of zinc chromate primer from aluminum.
5. An acidic material that strips certain organic finishes and simultaneously removes oil and rust.

For more information, phone your local Oakite Technical Service Representative or mail the coupon at the right.


WHAT'S THE BEST WAY TO STRIP METAL PARTS IN LARGE VOLUME?
See page 9
how to STRIP PAINT
with Oakite Materials & Methods
OAKITE PRODUCTS, INC.

Oakite's FREE booklet on "How to STRIP PAINT" answers many questions that will lead you to better stripping procedures. You'll want to read more about:

- ¶ What's the best way to strip paint from metal parts too large to be soaked in tanks? See Page 3
- ¶ What's the best way to strip large areas of structural metal where a steam supply is available? See Page 5. Where steam is not available? See Page 7
- ¶ What are the best ways to prepare stripped surfaces for repainting? See Page 11
- ¶ What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? See Page 12

FREE For a copy of "How to STRIP PAINT", write or send us the coupon.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS · METHODS · SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

OAKITE PRODUCTS, INC.
26 Rector Street, New York 6, N. Y.

Send me a FREE copy of your booklet "How to STRIP PAINT". Also, give me more information about the following new materials:

- ☐ alkaline strippers
- ☐ solvent strippers
- ☐ acidic cleaners and rust removers
- ☐ viscous solvent stripper
- ☐ stripper for aluminum
- ☐ paint-spray booth materials

Name _____

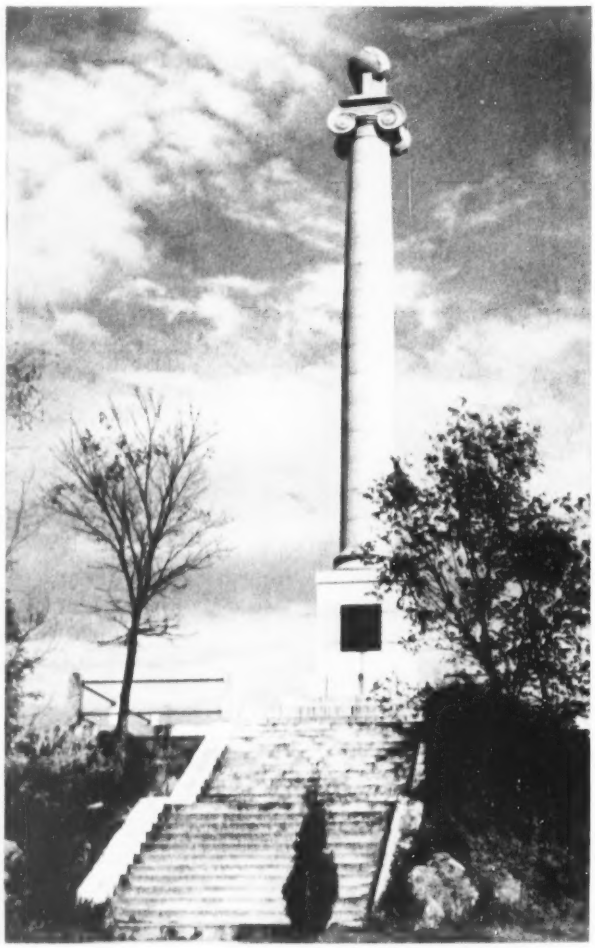
Company _____

Address _____

Advertisement

CUMBERLAND GROUND BARS

We manufacture 8″ diameter, 7-1/2″, 7″, 6-1/2″, 6″, and also odd and intermediate sizes down to and including 1-1/8″.

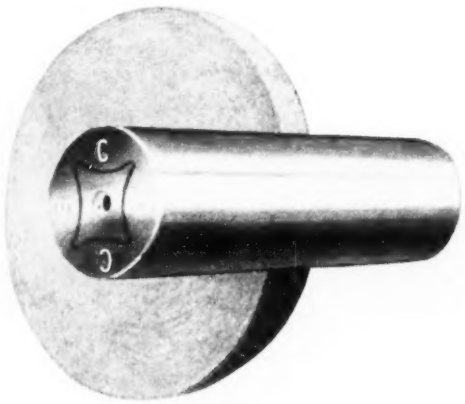


ON THE WEST VIRGINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was shown the Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of secrecy——."

At a later date GEORGE WASHINGTON said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to filing or fitting.

IMMEDIATE BARS

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Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkridge Brothers Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, N. Y.—Jos. T. Ryerson & Son, Inc.
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Worcester, Mass.—Pratt & Inman

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892

For more information on products advertised, use Inquiry Card, page 261

Switch to Graph-Mo® ends heat-treating problem, increases gage blank sales!

Graph-Mo steel gage blanks manufactured by HURON MACHINE PRODUCTS, Dearborn, Michigan

HURON Machine Products was having trouble heat-treating the oil-hardening tool steels it used for making gage blanks. Poor response to heat-treatment was causing cracks in the blanks.

Looking for an answer to the problem, Huron switched to Graph-Mo® steel, a special graphitic tool steel manufactured by the Timken Company.

Here's what happened when Graph-Mo steel was used:

Because Graph-Mo responds uniformly to heat-treatment, the cracking problem was eliminated. But that's not all.

Because Graph-Mo machines faster, machining time was cut, tool life lengthened.

And in addition to cutting production costs, Graph-Mo has helped Huron increase its sales. H. E. Lindemann, Huron president reports: ". . . the acceptability of Graph-Mo by gage users has been an important factor in our company's increased sales."

The difference in Graph-Mo steel and other gage steels can even be seen by the naked eye. The tiny, scattered parallel marks barely visible on the surface of a polished piece of Graph-Mo steel indicate the presence of free graphite in the steel's structure. This graphite, together with diamond-hard carbides, enables Graph-Mo to outwear other tool steels an average of 3 to 1, according to reports from dozens of users.

You can always tell Graph-Mo by its "graphitic look". This built-in trade-mark can't be duplicated in other steels. The next time you buy gages look for the "graphitic look" as well as the tag reading "this gage is made of Graph-Mo steel". The Timken Roller Bearing Company, Steel & Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

TIMKEN
TRADE-MARK REG. U.S. PAT. OFF.
Fine Alloy
STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

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Here's Good News for

U·S·S Free-Machining MX

is now available in OPEN HEARTH as well as BESSEMER

screw machine operators

The fact has been amply demonstrated that you can produce more parts per hour, that you can prolong tool life, minimize rejections, readily hold to tolerances and obtain better part finish by using MX screw stock.

In the past three years, the hundreds of shops that have put this faster-cutting bar stock into production have proved that MX will reduce the cost of *any* part by out-performing ordinary screw stock.

Such cost savings have averaged between 10 and 15%, sometimes ran as high as 40%. Today, you can confidently count on still bigger savings by using this steel.

And make a note of this. Now MX is also being produced in our Open Hearths to give screw machine operators a freer-cutting steel of the C-12XX type. This steel, especially controlled to improve cold-drawing characteristics, assures users of a fast-cutting bar stock not only of *excellent* surface quality but one that performs exceptionally well when finish-machined parts must be subjected to crimping or other deforming operations.

USS Free-Machining MX—either Open Hearth or Bessemer—is available in all the popular bar sections and sizes. You can obtain it in cold-finished form from your regular supplier as "MX" or under his own identifying trade name. In hot rolled form, MX is available direct through our nearest district sales office.

USS

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

UNITED STATES STEEL

For more information on products advertised, use Inquiry Card, page 261

Whether your dies are simple...

you can speed production, save time and money,

Actual performance records prove carbide dies effective over wide range of uses

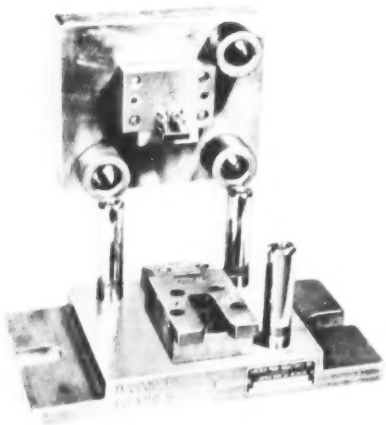
ACTUAL plant performance has proved how easy and profitable it is to use Carboloy cemented carbide over a wide range of applications. For blanking, forming, drawing and piercing . . . for large or small, simple or complex dies . . . only carbides will give you benefits like these:

- **Production runs 35 times greater than steel (see picture No. 7)**
- **Over two million high-speed strokes . . . without needing resharpening (see picture No. 1)**
- **Accurate tolerances held for months . . . compared to days with steel (see picture No. 6)**

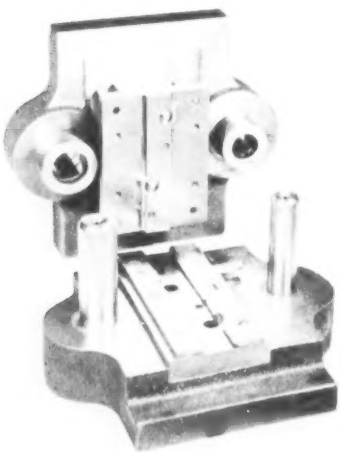
Read the case histories on these pages. They are but a few from the wide range of carbide press-die applications. Then explore the possibilities of carbide in your press dies. Carboloy personnel and services will give you or your die maker every possible assistance.

If you wish, a Carboloy Sales Engineer will call at your plant, without obligation. He'll show you how simple it is to apply and maintain carbide dies; how to get increased production with fewer rejects. Or, you can send your key personnel to the Carboloy Training School in Detroit.

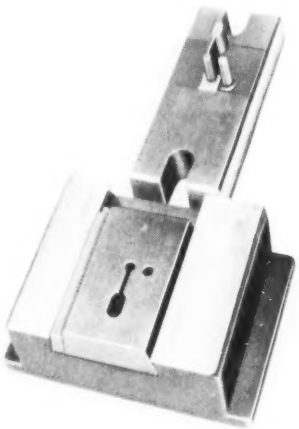
Also, you can get free Carboloy Die Engineering Manual D-124. It shows you how easy it is to design, apply and maintain carbide dies. Get all these free, profit-building Carboloy services by mailing the coupon at right.



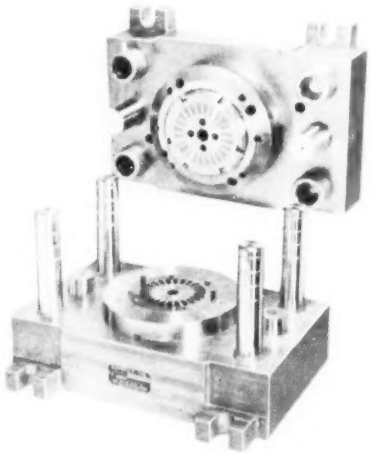
1 Simple pierce and cutoff die, designed for Electric Auto-Lite Co., Toledo, operates at speeds faster than 400 strokes per minute. Die has produced over 2,000,000 strokes . . . and still does not require resharpening.



2 Simple progressive washer die, used at Precision Spring Company, Detroit, Michigan, pierces and blanks spring-tempered steel washers. This die delivers several million hits per sharpening.



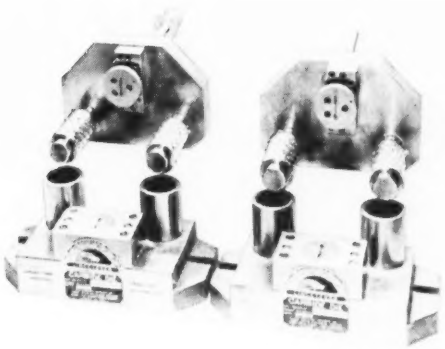
3 Notching die, wearproofed with Carboloy cemented carbide, stands up under severe day-after-day pounding. Because carbide wears 10 to 50 times longer than steel, maintenance costs are lower.



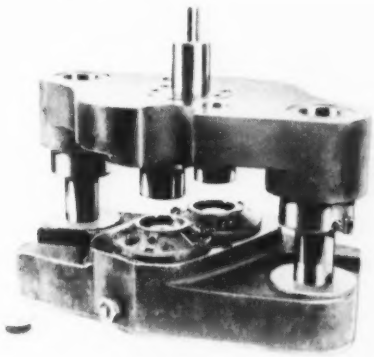
4 Piercing die, made for E.M.F. Dordt, Holland, was designed to pierce a small stator in 24 places. When dies have been wearproofed with cemented carbide, production increases, downtime decreases.

or whether they are complex

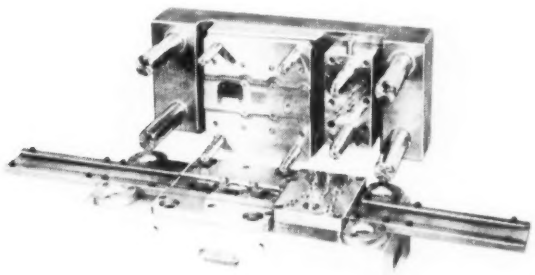
by equipping them with CARBOLOY
CEMENTED CARBIDE



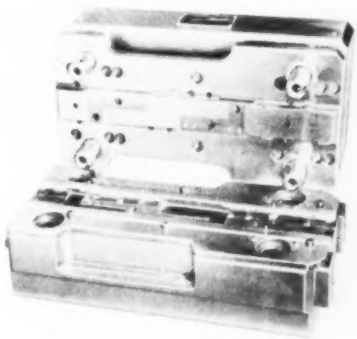
5 Single notching dies, also made for E.M.F. Dordt, Holland. Special design permits details to be interchanged on the same shoes to take full advantage of the carbide in short-run production.



6 Blanking and drawing of screw bottle caps is done by this die for Armstrong Cork Company, Lancaster, Pa. Die operated accurately on material .006" thick for months. Steel die had to be changed each week.



7 Lamination die made for Schick, Inc., produces rotor and stator laminations of motor-grade silicon steel. Customer reports carbide die produces average runs 35 times as long as steel dies.



8 Lamination die punches two, 1¼-silicon "L" laminations per stroke. Dies of this type are in use throughout the metal-working industry, outwearing and outproducing steel dies time and again.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for the products of the Carboloy Department of General Electric Company

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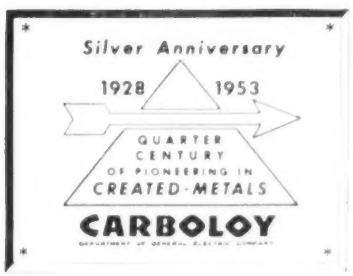

CARBOLOY Department of General Electric Company
11147 E. 8 Mile Road, Detroit 32, Michigan

- ☐ Rush me free Carboloy Die Engineering Manual D-124
- ☐ Send complete details on free Carboloy Training School
- ☐ Have a Carboloy Field Engineer call at my plant

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Company _____

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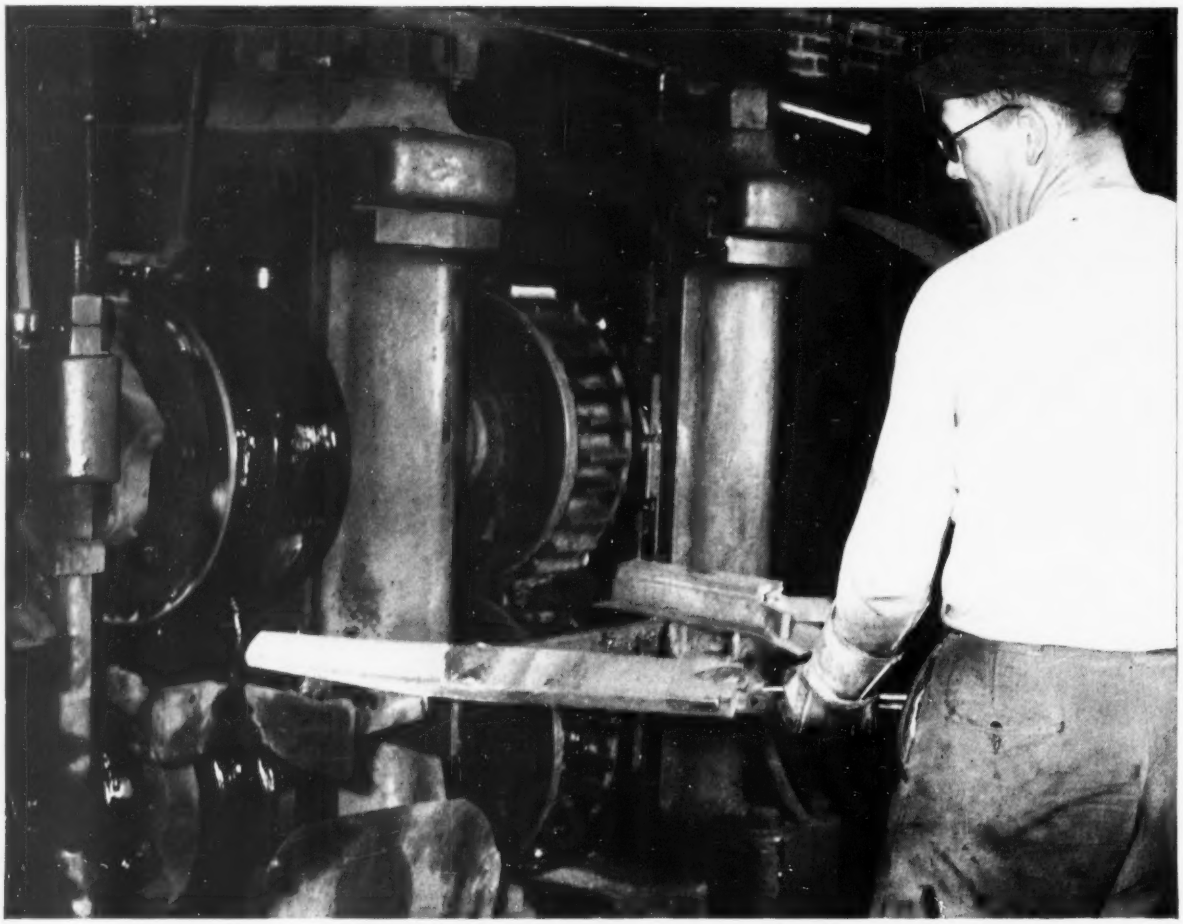
City _____ Zone _____ State _____



10 TIMES THE PRODUCTION LIFE

FROM THESE "CAST-TO-SHAPE" SWAGING DIES

SEND FOR THIS NEW CATALOG
"FORGING AND CASTING PRODUCTS"

It's hot off the press with full details on FCC Air Hardening, Oil Hardening and other Cast-to-Shape Tool Steel Specialties that can save you time and money . . . also Composite Die Sections, and Smooth-Hammered Forgings in a wide range of tool and stainless steels. *Don't wait—get your copy NOW.*

Write Today

ADDRESS DEPT. M-47

The John Deere Plow Works of Deere & Company formerly used cast grey-iron dies to swage AISI 1070 F steel plow beams. Die life was, at best, a mere six weeks or about 8,000 parts.

They switched to A-L CAST-TO-SHAPE swaging dies of FCC No. 66 tool steel, hardened and drawn to 57-58 Rockwell "C". The new dies ran *fourteen months*—eight hours a day, five days a week—before redressing was necessary. Approximately 83,875 *Parts* (over ten times the production) were swaged in that period! Production has been maintained at that level since.

You, too, can save time and money with the modern FCC CAST-TO-SHAPE method of tool and die making. Don't forget, you also buy *less* steel and reduce machining costs. It's a matter worth investigating. ● Check with your A-L representative TODAY . . . or write *Allegheny Ludlum Steel Corporation, Oliver Building Pittsburgh 22, Pennsylvania.*

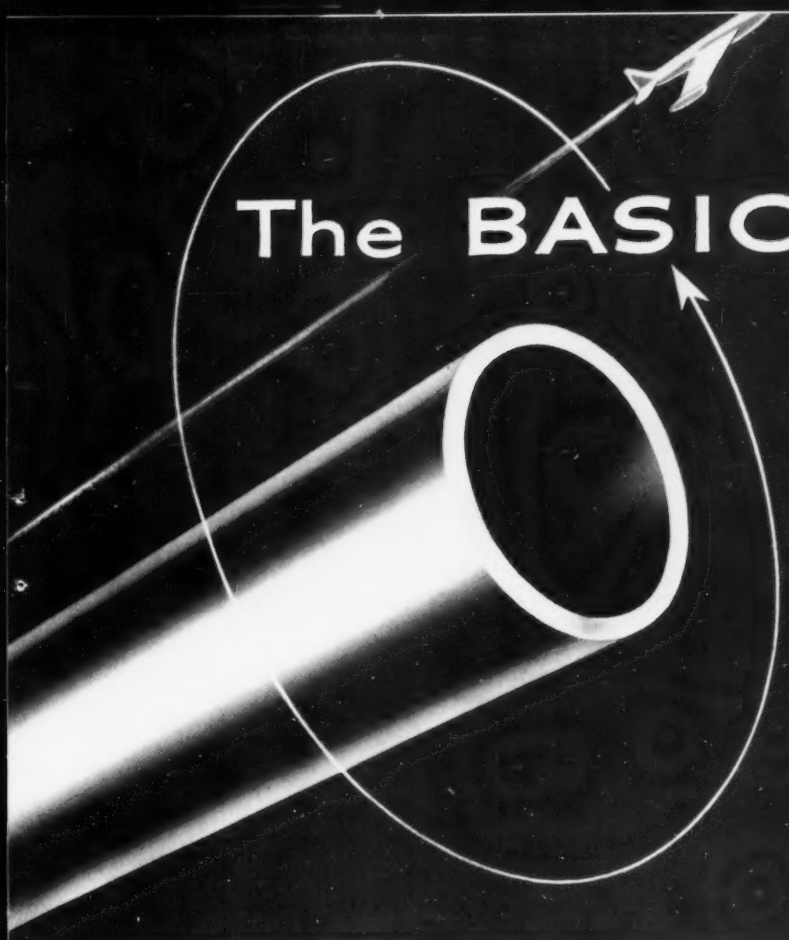
For complete MODERN Tooling, call

Allegheny Ludlum

AL
FINE TOOL STEELS
SINCE 1854

For more information on products advertised, use Inquiry Card, page 261

The BASIC SHAPE of things to come!



WHEN you use Shelby Seamless Mechanical Tubing for hollow cylindrical parts, the basic shape—the tube—is already made.

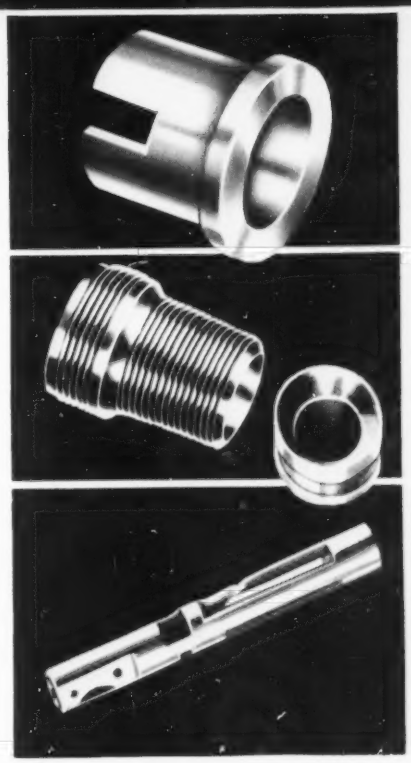
You pick up the job where Shelby leaves off, and you find that it requires much less cutting or boring than solid bar stock or forgings would.

You fashion the most complex of parts, yet you produce them faster and at lower cost than identical parts machined from solid bar stock.

You turn out a far better precision product, yet fewer operations are involved, man and machine hours are reduced, rejects are fewer, and over-all parts production is speeded up.

In some instances, the use of Shelby Seamless Tubing has increased production to such a degree that savings of 50 percent have resulted.

Shelby offers you the high strength, the uniformity, the dependability that only *seamless* tubing can give. And it's available in a complete range of diameters, wall thicknesses, and analyses to meet the most exacting requirements. If you're interested in cutting production costs—and who isn't?—while turning out a superior product, send for our free Bulletin Number 17. And feel perfectly free to call on our engineers if you need help in applying Shelby Seamless Steel Mechanical Tubing to your product.



NATIONAL TUBE DIVISION
UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL

Here are a number of crankshafts of various sizes and types. They will be delivered ready for installation with National Forge's guarantee of satisfactory performance.

FINISH MACHINING IS A SPECIALTY AT NATIONAL FORGE

NATIONAL FORGE has excellent facilities for the finish machining of forgings. Our 1260-foot main aisle and the side bays house a multiplicity of precision tools.

There is a full complement of lathes for both turning and boring in sizes from small bench lathes up to lathes of 72" swing and beds up to 120'; boring mills, vertical and horizontal; planers; radial drills up to 6'; surface grinders for flat work; cylindrical grinders for work up to 26" diameter and 50' long; shapers — horizontal, vertical and traveling head; milling machines — vertical, horizontal and planer type; a jig borer; pin-turning lathes for crankshafts; slotters, up to 36" stroke; and many other machines and tools designed for special work.

Our machinists are carefully trained over the years, and wherever your operation calls for special skill, these men are expertly adapted to your work.

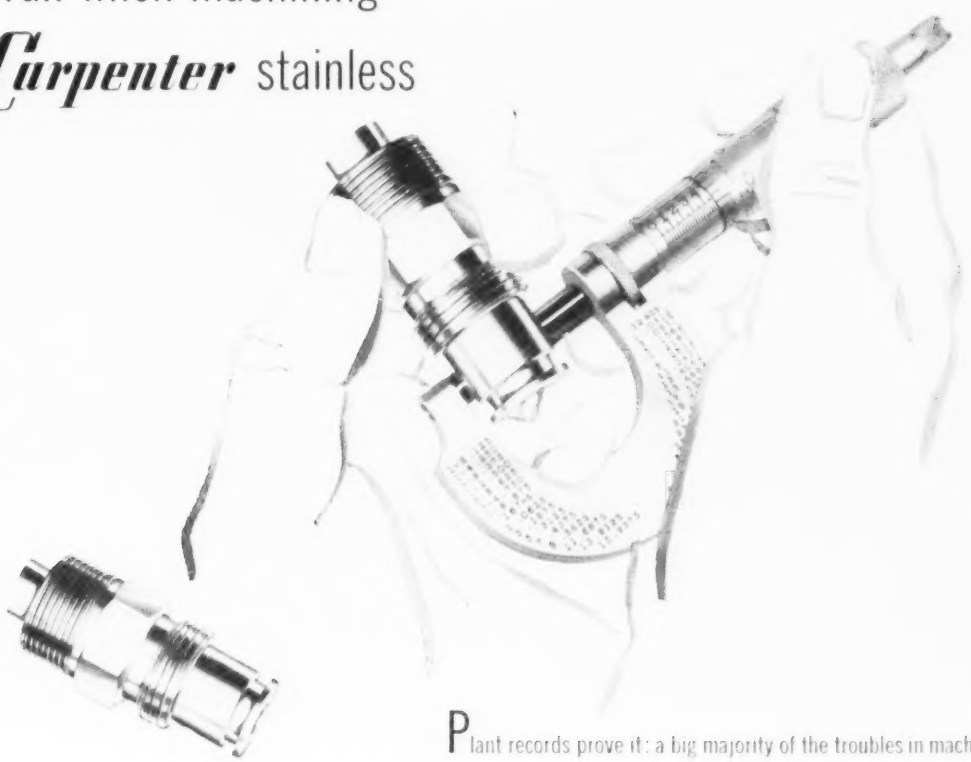
When you have finish machining to be done on a forging, no matter how intricate or how close the tolerances, you can depend on National Forge to turn it out to your exact specifications.

We will be glad to quote on any job you have . . . and our Engineering Service is available to assist you if you desire.

National Forge
AND ORDNANCE COMPANY
Irvine, Warren County, Pennsylvania

For more information on products advertised, use Inquiry Card, page 261

You get a far higher number of **good ones** on each run when machining *Carpenter* stainless



Plant records prove it: a big majority of the troubles in machining stainless parts just aren't necessary! That's why we'd like to show you what can happen when you change from a run-of-the-mill free-machining stainless to a Carpenter Free-Machining grade. Records prove that on many jobs, rejects take a nosedive, tool life goes up, and costs down. That's because Carpenter Stainless is made in a specialty tool steel mill to highest tool steel quality standards. The same careful controls are applied to make sure every bar of Carpenter Stainless will work the same. It stands to reason that with Stainless like this you can get more good parts out of the lot. Isn't it worth a try? Just specify "Carpenter" on your next production order. The Carpenter Steel Company, 105 W. Bern St., Reading, Pa.

Export Department: The Carpenter Steel Co., Port Washington, N. Y. — CARSTEELCO

Rejects on this needle valve part dropped 30% when the company changed to Carpenter No. 8, Type 303.

Carpenter **Free-Machining Stainless**

takes the problems out of production

Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor

MILES APART IN SIZE AND WEIGHT

Here are two Bethlehem drop forgings that happened to be going through the shops the same day. The small connecting rod weighed only a pound and a half. The big one, a pretty husky specimen, couldn't be cradled in anybody's hands. It weighed more than a hundred times as much as the little fellow.

This contrast isn't unusual, for Bethlehem makes drop forgings ranging in weight from a few ounces up to 250 lb. Through the years we've produced literally millions of them—gear blanks, connecting rods, hooks, wrenches, links, rings, crankshafts, tool parts—and so many other designs it's hard to estimate the number. These forgings have gone into scores of industrial fields, including petroleum, mining, aviation, power, and transportation.

Today we're better fixed than ever to fill your needs in closed-die forgings. Ours is a fully-integrated operation—everything from making the steel to cleaning and shipping the finished forgings. Call us the next time you're in the market! We'll welcome the chance to work with you and your staff.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM DROP FORGINGS

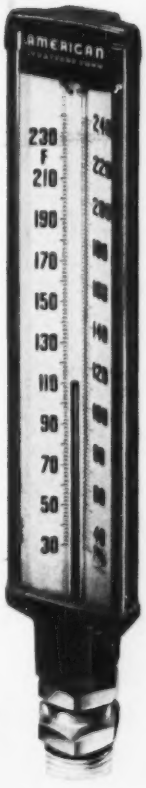
Bronze Extrusion makes a stronger sales case for this industrial glass thermometer

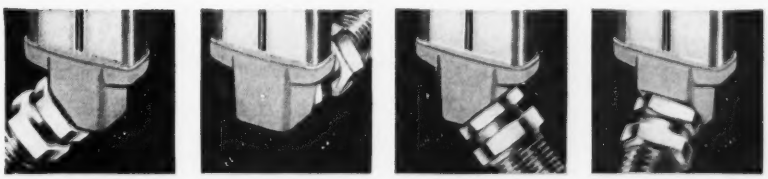
The case for this "American" Industrial Glass Thermometer made by Manning, Maxwell & Moore, Incorporated, Stratford, Conn., used to be a steel stamping. Now it's made of ANACONDA Extruded Bronze.

Why the change? Because this extruded bronze shape makes a far stronger and more rigid case; it's easier to produce; it simplifies assembly—and adds additional quality to an already high-quality product. So accurate are these bronze extrusions that neither straightening nor machining is needed for assembly. And assembly time itself is cut.

For the base, an ANACONDA Brass Die Pressed Forging is joined to the case by brazing to provide greater joint strength. By machining the appropriate face of a single-style base forging, a stem connection can be provided at any angle.

ANACONDA Brass and Bronze have long been making a stronger "case" for products—by simplifying production; by the higher quality that is always associated with products made of brass or bronze; by increasing sales appeal. We urge you to consider the advantages of these metals for your manufacturing processes and your products. For information, write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.





Base forging can be machined to provide stem connection at any angle and direction.

Extruded case and forged base for this 9-in. "American" Thermometer are joined in perfect alignment by brazing. No machining or straightening is required.

ANACONDA®—the name to remember in COPPER—BRASS—BRONZE

LATHE CARRIAGE FLEXIBILITY

Nichols Miller

PRODUCTION MODEL

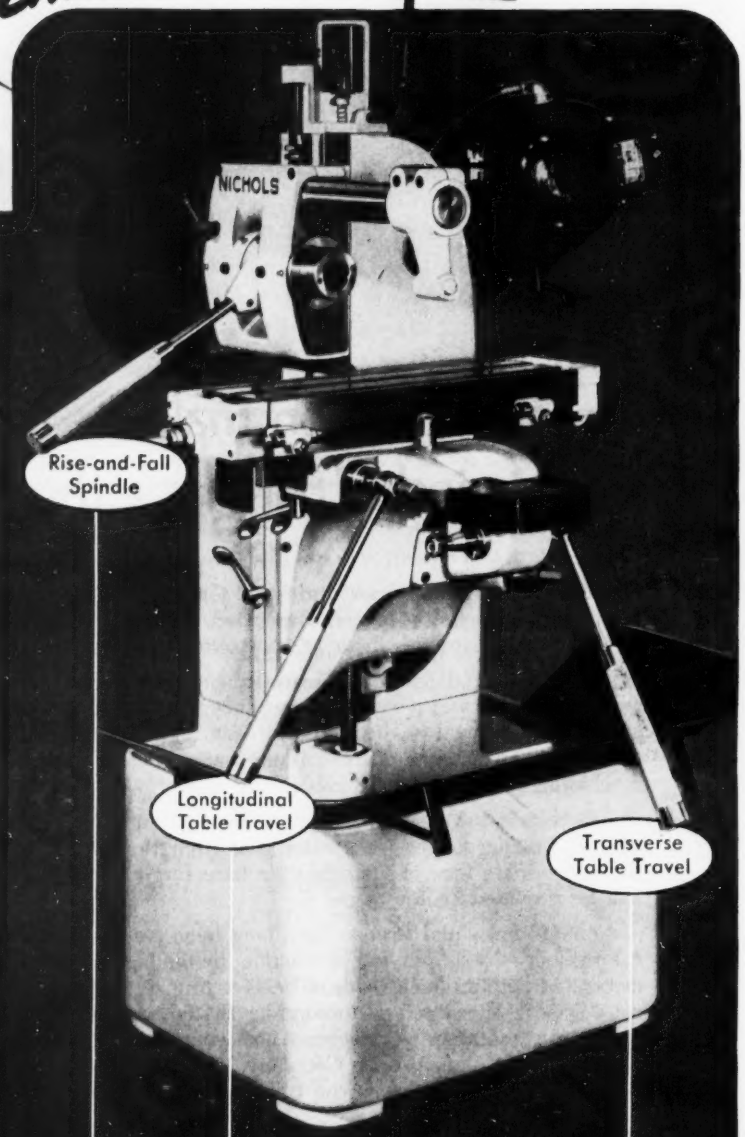
Precision turning, boring and recessing jobs that are normally assigned to toolmaker's lathes or expensive boring machines, come natural to the versatile NICHOLS Millers.

Rapid Lever Actions on the Spindle Head, Table, and Saddle provide unparalleled flexibility of movements. The Lever Transverse Feed, an exclusive NICHOLS development, is especially valuable. Makes NICHOLS different from other hand millers. It adds *"lathe-carriage flexibility"* to your most intricate machining operations, while maintaining tolerances to "tenths." Work can be chucked lathe-fashion on the spindle with tools mounted on the table or vice versa.

Adjustable positive stops, quick-acting locks on sliding movements, and the highest degree of precision are standard equipment.

"THE MILLER THAT USES ITS HEAD"

Send for free illustrated brochure.



RAPID LEVER ACTIONS

MANUFACTURED BY W. H. NICHOLS COMPANY, WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS

NICHOLS-MORRIS CORPORATION

76-E MAMARONECK AVE., WHITE PLAINS, N. Y.

CONDENSED SPECIFICATIONS

Table Working Surface	6¾" x 21"
Longitudinal Table Travel	10"
Transverse Table Travel	7"
Vertical Travel of Knee	13"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to	5000 R.P.M.
Weight	1250 lbs.

For more information on products advertised, use Inquiry Card, page 261

THESE THREE PARTS PRODUCED BY

Hydroforming

at a saving of $30,900 in tool costs!

Faced with a tool cost estimate of $34,500 to produce the three parts shown above by conventional methods—and a four-month wait for die delivery—a prominent manufacturer then investigated Hydroforming.

Within 30 days' time—and at a total cost of $3,600 for tools—the required quantity of these complex parts was produced with ease on a 32" Cincinnati Hydroform machine.

The illustrations and accompanying descriptions of these parts indicate the *versatility* of the Hydroforming process . . . and this bona-fide example of comparative time and tool cost savings indicates its *economy!*

Have *you* considered Hydroforming? Call in a Cincinnati Milling field engineer. For a description of the five sizes of Hydroform machines, write for Bulletin M-1759-2.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U.S.A.

a 13" ID, 8⅛" deep. Drawn from a 21" blank of ¼" stainless in two operations.

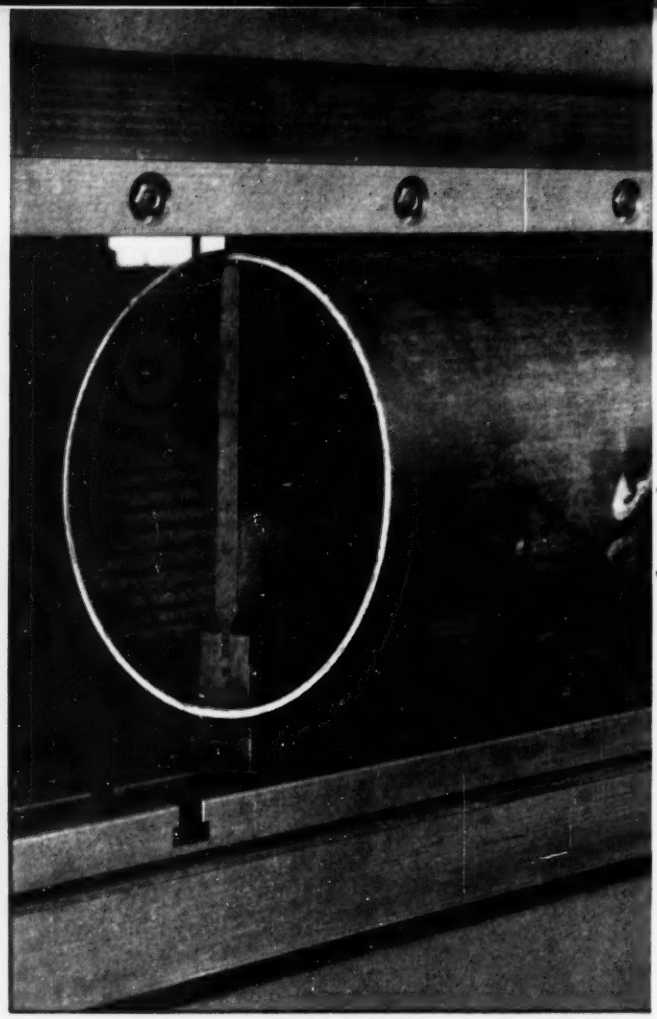
b 22¼" ID, 7⅜" deep. Drawn from a 32" blank of ⅛" stainless in one operation.

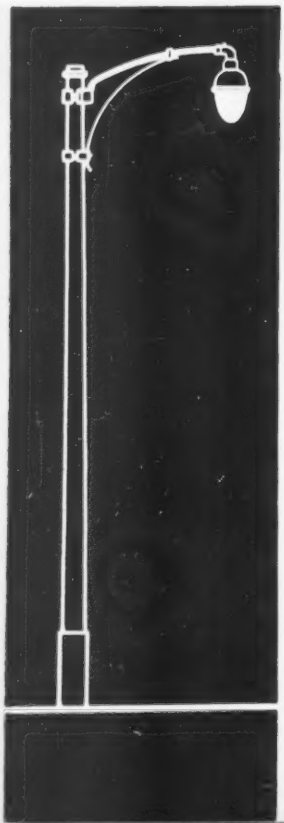
c 21½" ID, 4¾" deep with a reverse draw 4⅛" deep. Drawn from a 32" blank of ⅛" stainless in three operations.

CINCINNATI

pipes ...tubes ...posts

...ACCURATELY and EASILY formed on

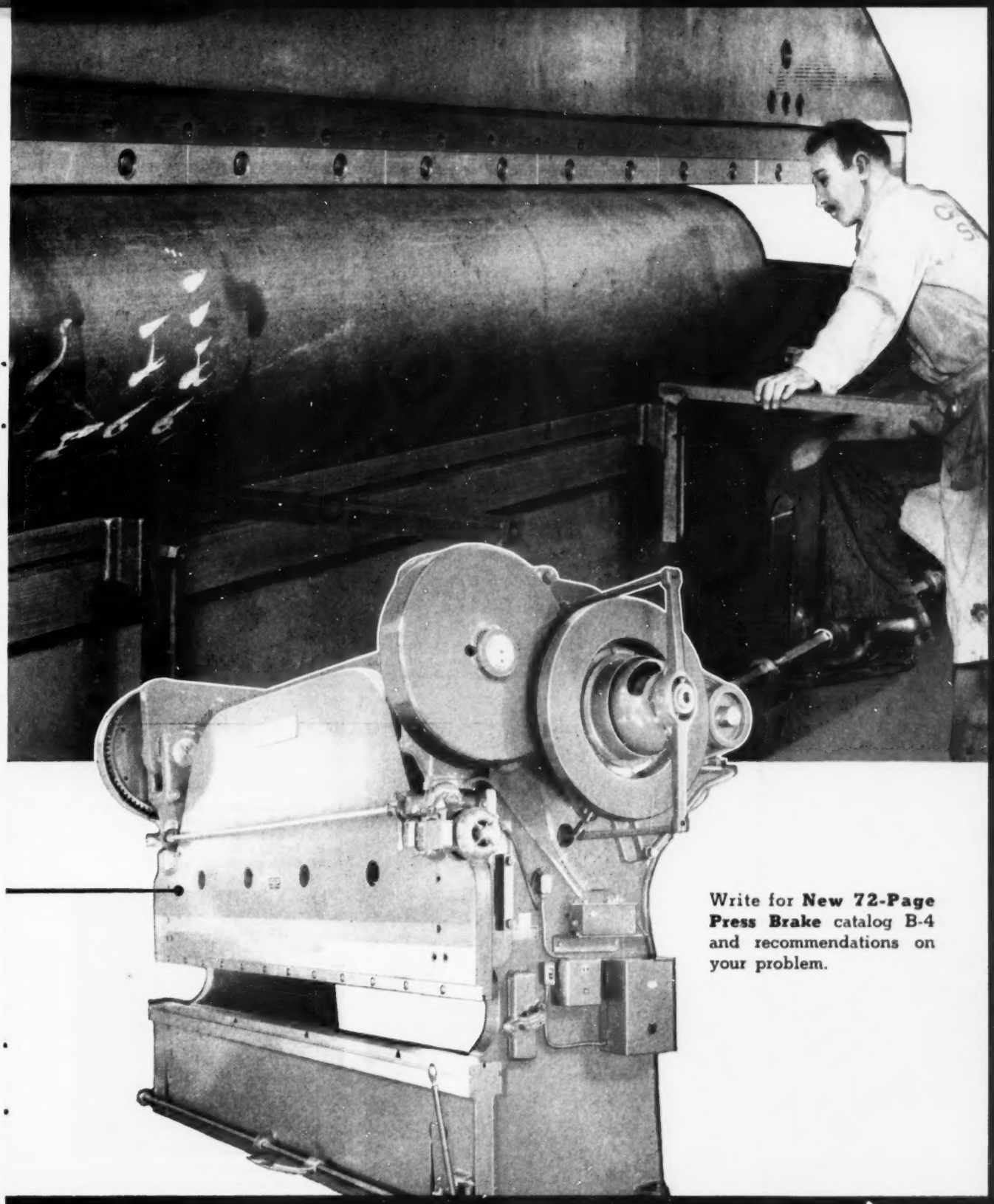




Cincinnati Press Brakes

Large diameter pipes and tubes can be completely formed on versatile Cincinnati Press Brakes. Round, tapered lamp posts up to 30 feet long are also formed by prekinking the edges and then completing the tapered tube in several additional hits on taper dies.

Cincinnati Press Brakes also crimp sheet and plate before rolling to eliminate flats at the seam edges.



Write for **New 72-Page Press Brake** catalog B-4 and recommendations on your problem.

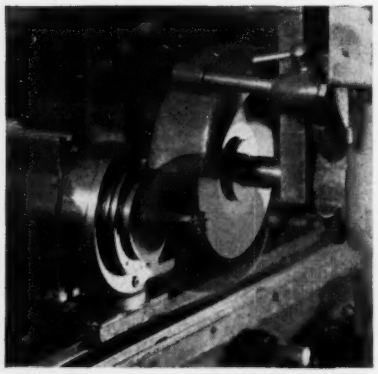
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

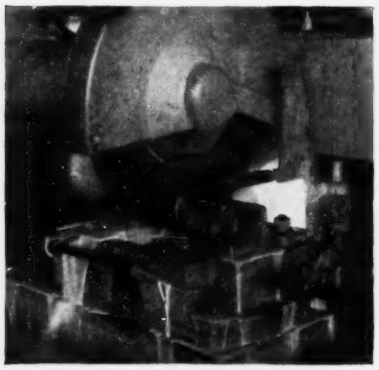
CINCINNATI

The new R50 has built-in chip clearance. Designed primarily for wet-cutting of metal bar stock, this new Norton rubber bonded cut-off wheel handles diameters up to 2½" on chopper machines and up to 6" on oscillating machines. Built-in chip clearance, unusual in this type of wheel, is one of the reasons why the R50 cuts freer and cooler, without case hardening the ends of the stock.

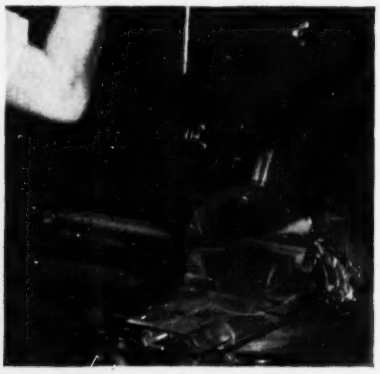
The BN covers a wide job-range. You can't beat the long popular Norton BN wheel for general, all-around usefulness. Or for safety either, because the strong reinforcement of this resinoid bonded wheel practically eliminates breakage from the cutting-off picture. Uses include: notching, slotting and cutting-off gates and risers from non-ferrous castings; cutting wire rope; slotting railway track welds; tuck pointing; cutting non-metallic materials such as fibre board, concrete, tile, plastics, and the like.



The B2 is versatile. Handy as a general purpose cut-off wheel for the tool room, the Norton resinoid bonded B2 is also used for lighter jobs on plastics, marble, carbon, brake lining and other non-metals.

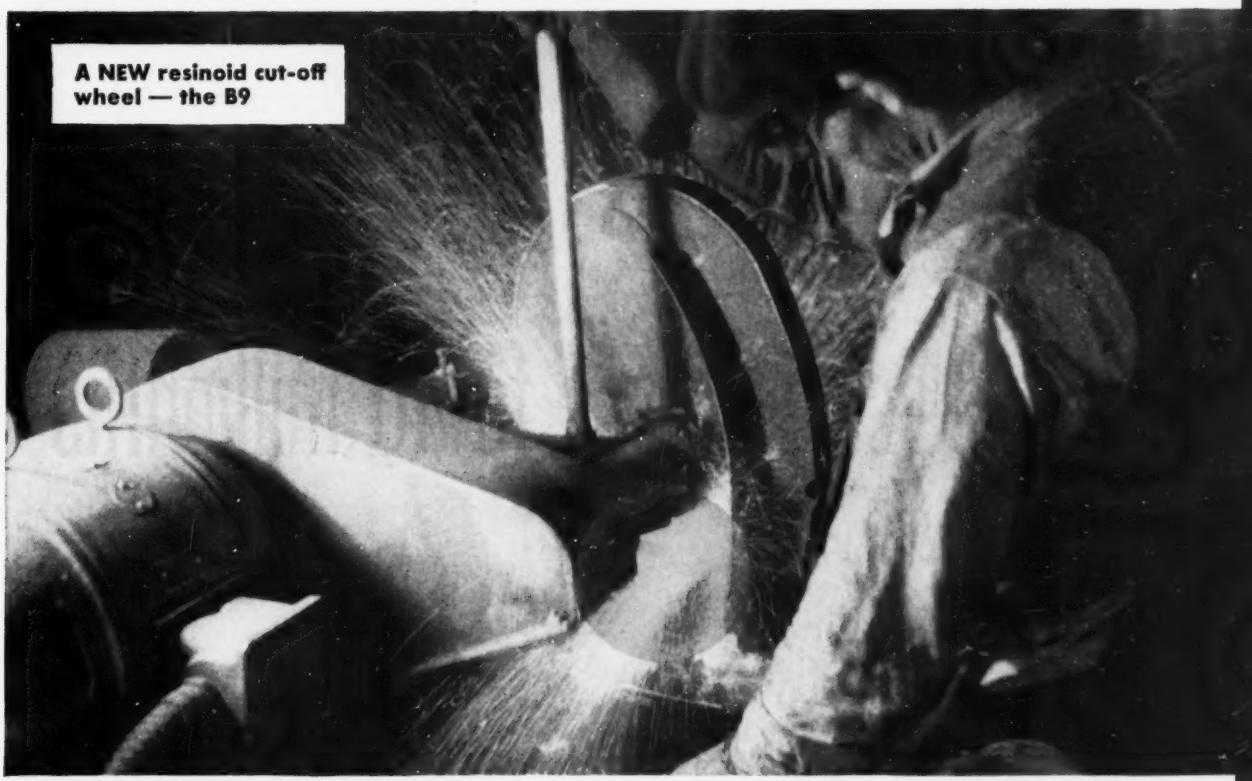


The R30 is standard. The bond used in the Norton R30 is the standard rubber bond for smaller wheels and is preferred for jobs such as cutting-off thin tubing, small diameter work and fine slotting.



The R20 is rugged. A very durable wheel, the Norton R20 has the strongest of rubber bonds. An ideal wheel for dry-cutting of metal rods and other jobs where dressing action is particularly severe.

W—1520



The new B9 is as fast-cutting as they make 'em. Adaptable to speeds up to 16,000 surface feet per minute, the new Norton B9 cut-off wheel is a real production booster. Resinoid bonded and available with either smooth sides, or with the rougher "F" sides for greater chip clearance, it's a cool-cutting, non-burning performer on all types of metals.

Add the "TOUCH of GOLD" to all your cut-off jobs

Your cutting-off jobs may involve ferrous or non-ferrous metals of any degree of hardness — or non-metals ranging from rubber hose to marble. Your machines may be high speed or low speed — swing frame, chopper, traverse, floor stand or portable. The point to remember is:

With the right Norton cut-off wheel you're sure of the fast, safe, clean-cutting performance that adds the profit-boosting "Touch of Gold" to every job.

Norton cut-off wheels are made with resinoid, rubber and shellac bonds, in ALUNDUM* (aluminum oxide) abrasive and CRYSTOLON* (silicon carbide) abrasive, and in a complete range of sizes. Whatever its type, you can count on every Norton cut-off wheel for the easy handling and exceptional breakage-resistance that mean happier operators and higher production.

Your Norton distributor will be glad to recommend the *right* cut-off wheels for your jobs. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

NORTON
ABRASIVES

Making better products... to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

Here's another reason it pays to get a proposal from Fosdick

We check flatness to 40 millionths

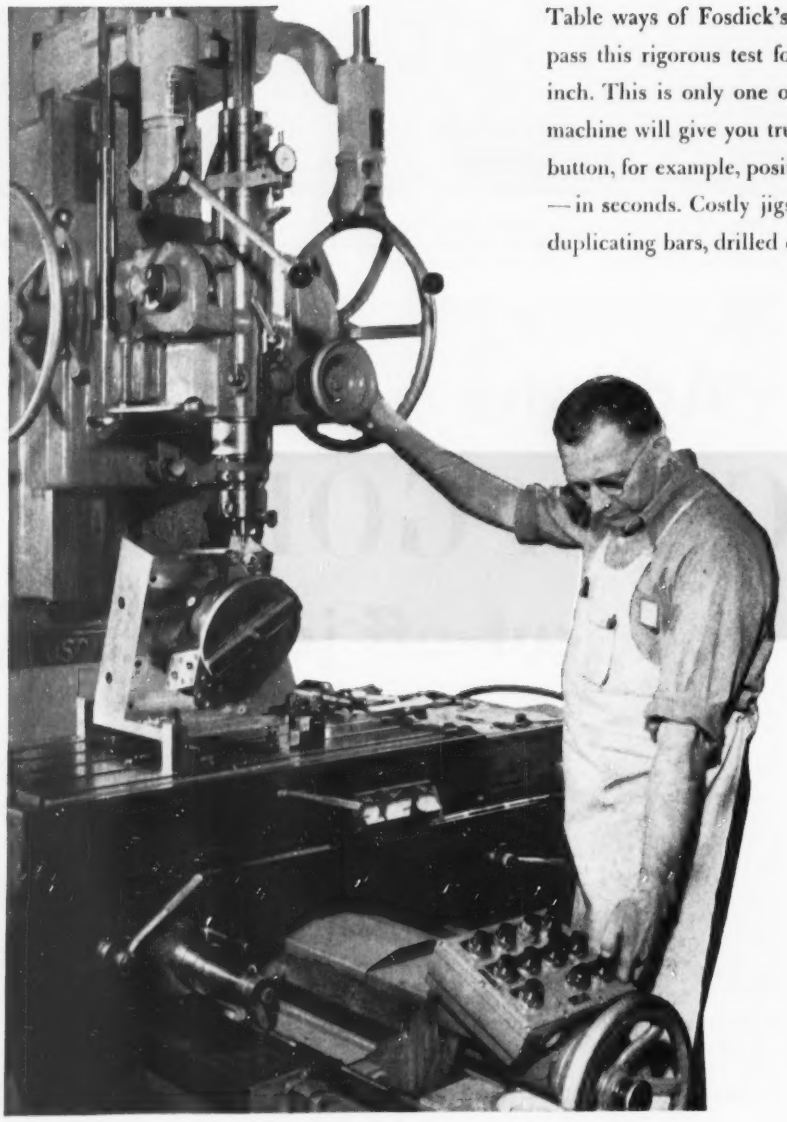


Table ways of Fosdick's Automatic Positioning Machine must pass this rigorous test for flatness—within 40 millionths of an inch. This is only one of many tests we run to make sure this machine will give you true precision production. The touch of a button, for example, positions work for each new hole to ± .0001″ —in seconds. Costly jigs have been replaced by two $\frac{5}{8}$″ square duplicating bars, drilled quickly for the job, stored easily.

to give you

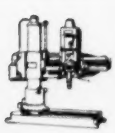
Boring Time "Nose Dives" at Fairchild.

Mass production of precision magnesium housings for commercial and military cabin pressurizers at Fairchild Engine and Airplane Corp. demanded speed and high accuracy. Fosdick's proposal recommended Automatic Positioning Machines. Now Fairchild drills, faces and bores $\frac{31}{32}$″ holes with accuracy to ± .0001″— *has slashed boring time 40% over former methods.*

For full description of the Automatic Positioning Machine ask for Bulletin APM

precision production like this

Need Drilling Equipment? Get a Proposal from Fosdick!


Radial Drills

Jig Borers

Sensitive and Upright Drills

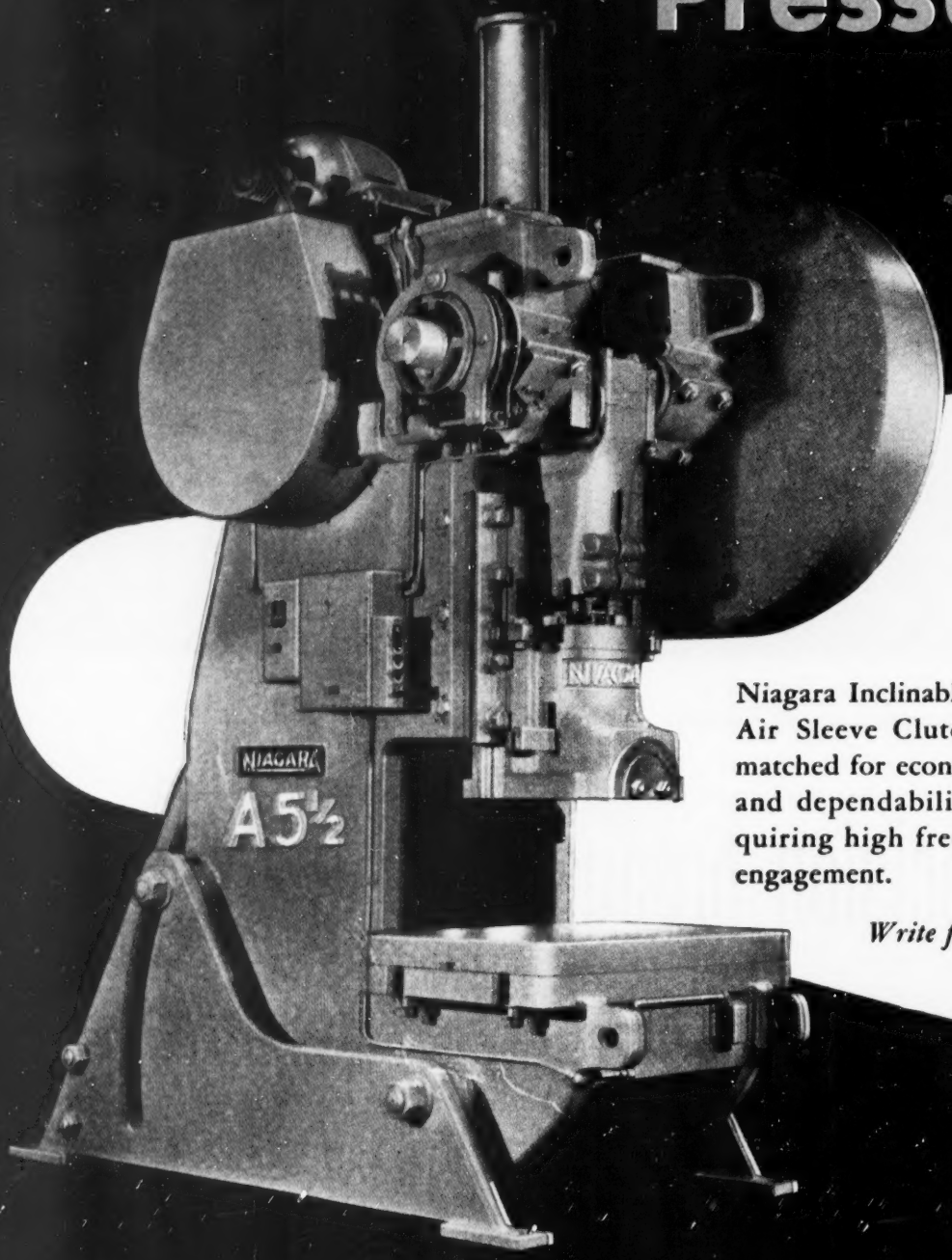
Sensitive Radial Drills

Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

NIAGARA Inclinable Presses



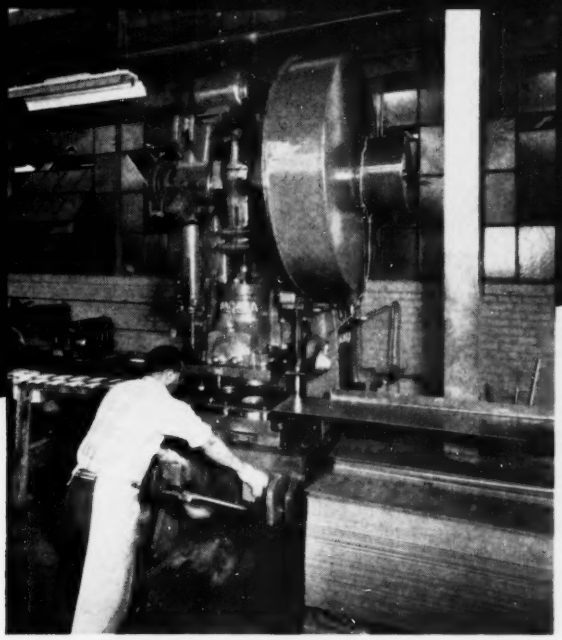
Niagara Inclinable Presses with Air Sleeve Clutch cannot be matched for economy, efficiency and dependability on jobs requiring high frequency clutch engagement.

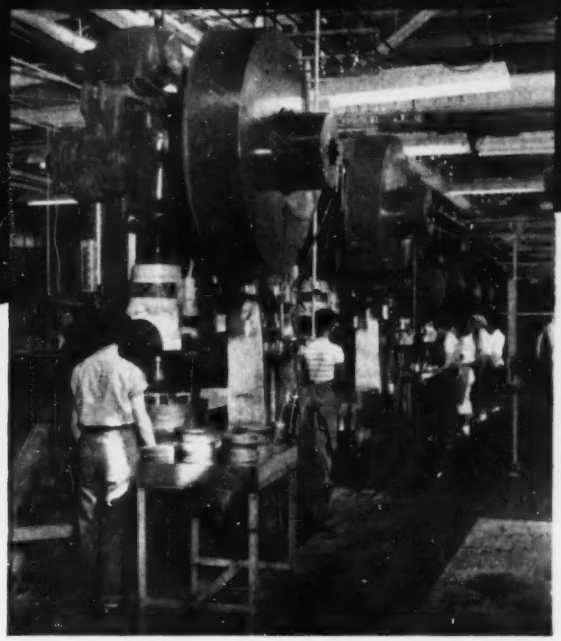
Write for information.

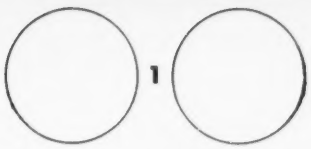
NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

On the Production Line

AT SHWAYDER BROTHERS, INC., DETROIT

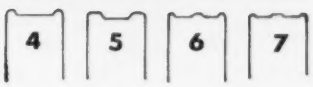






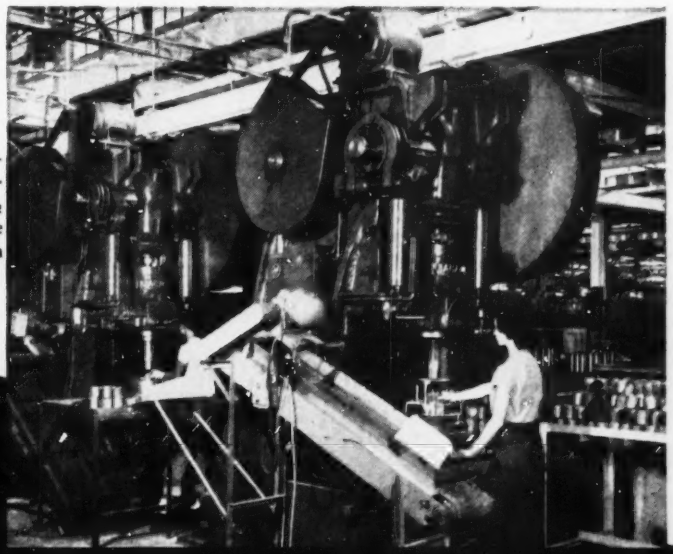
1. Punching two round blanks per stroke on Niagara A-5½ Press with Air Sleeve Clutch.

2, 3. Cupping and Redrawing on A-5½ Presses with Air Sleeve Clutches.



4, 5, 6, 7. Indenting end on A-3½ Presses.

8, 9. Forming hexagonal shape and Ironing side wall on A-5½ Presses with Air Sleeve Clutches and with Niagara Cushions.



The final piercing and tapering operations are done on A-3½ Presses (not shown.)

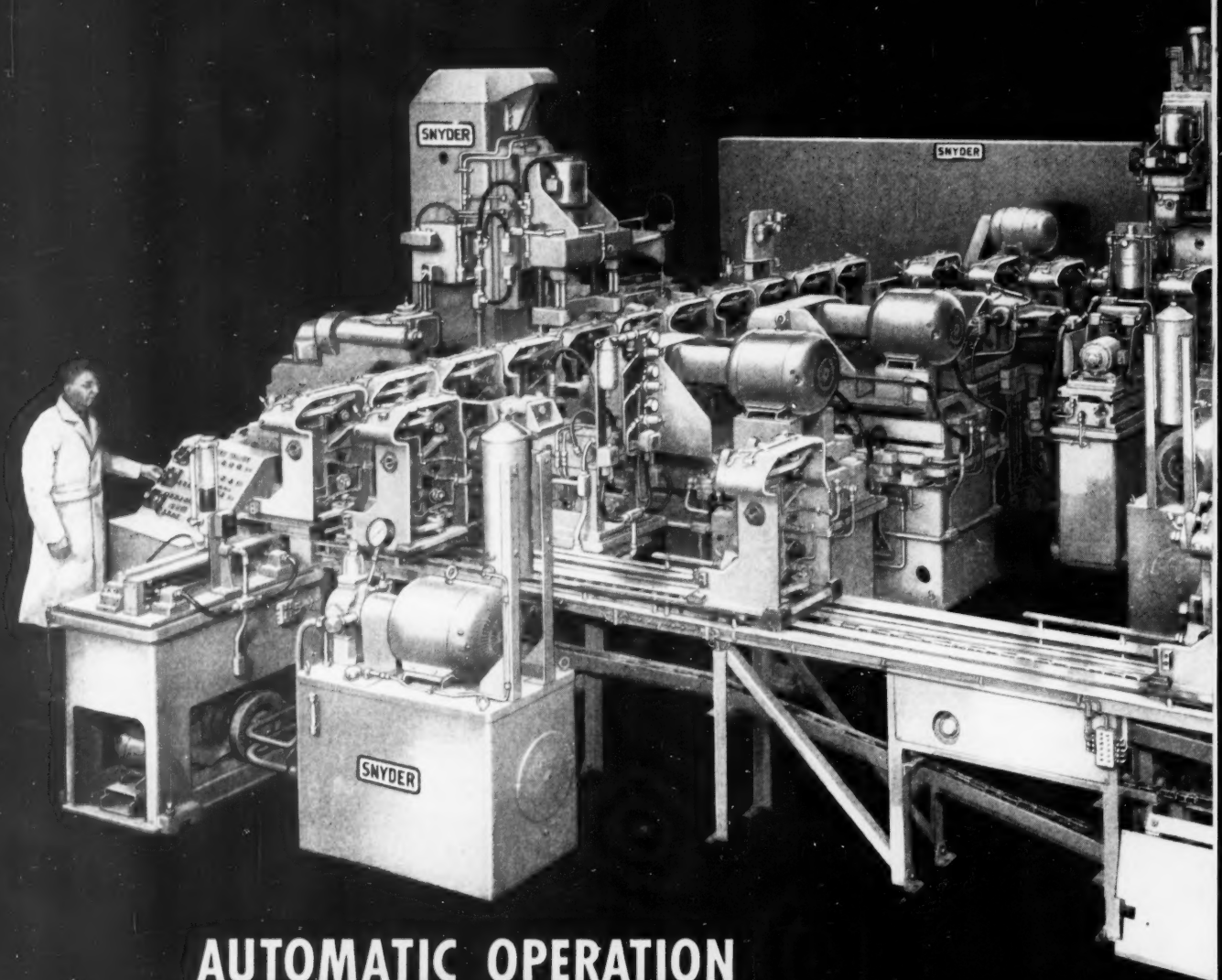
NIAGARA

America's Most Complete Line of Presses, Shears, Machines and Tools for Sheet Metal Work

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries

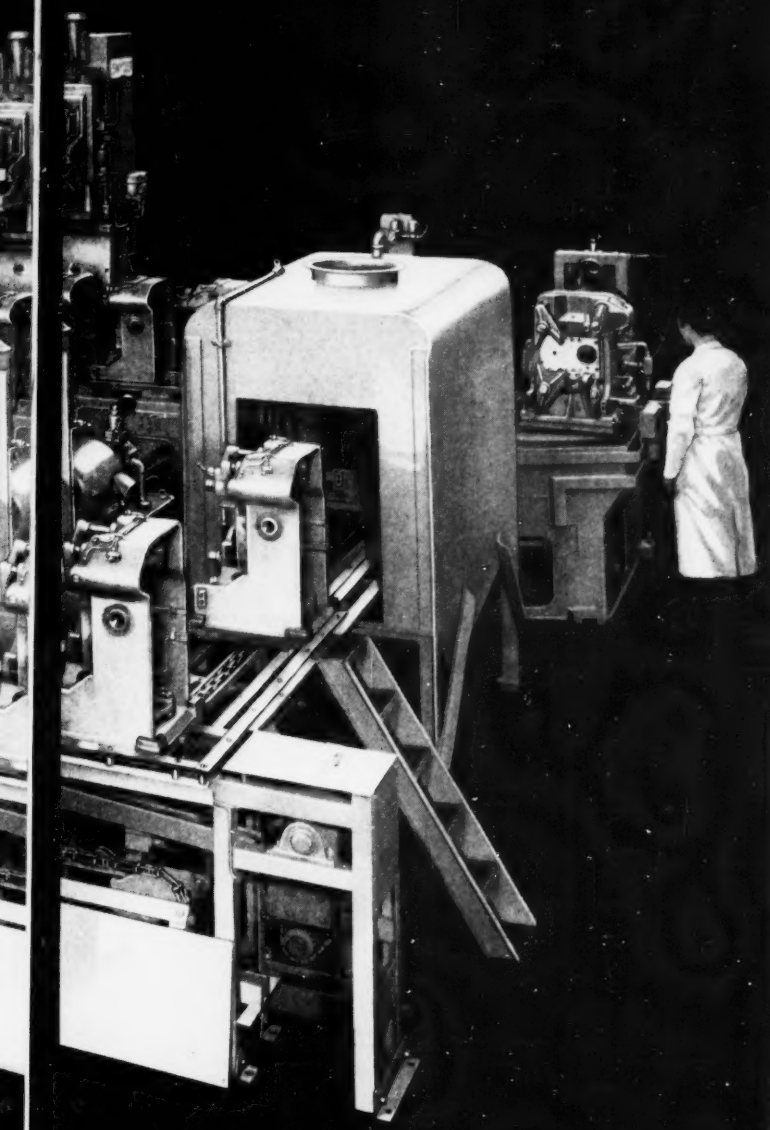
SNYDER MACHINES CONTROL COSTS

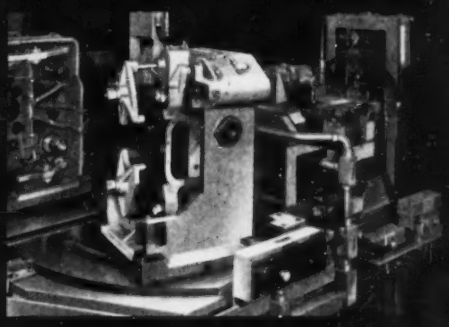


AUTOMATIC OPERATION

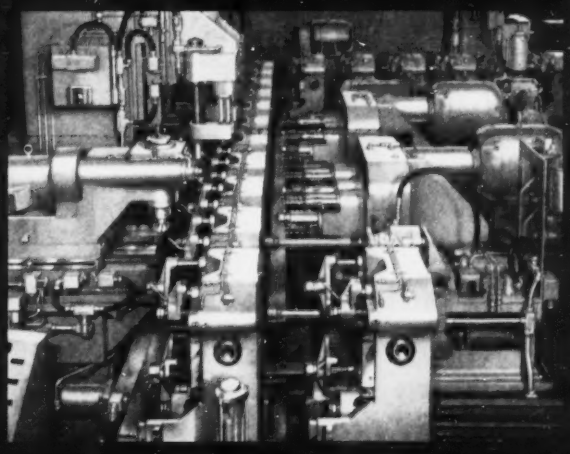
MILLS, DRILLS, TAPS, BORES, COUNTERBORES, COUNTERSINKS FRONT COVERS FOR AUTOMOTIVE ENGINES • AUTOMATIC INDEXING, LOCATING, CLAMPING, AND RELEASING • AUTOMATIC TRANSFER THROUGH TWO-STAGE, CONTINUOUS WORK CYCLE • AUTOMATIC CONTROLS • AUTOMATIC SAFETY INTERLOCKING SYSTEM • AUTOMATIC LUBRICATION • AUTOMATIC CLEANING AND CHIP REMOVAL • SKILLED OPERATORS NOT NEEDED

18 STATION AUTOMATIC TRANSFER
180 FRONT COVERS AN HOUR AT 100% EFFICIENCY





At Station 18 the fixture is rotated 90°, air wrenches unclamp the part so that it is easily removed. The fixture returns to Station 18, engages the return conveyor, is automatically blown clean and returned to the loading station.



Fixtures leaving Section 1 (above) move at right angle so that the other faces and top of the part are exposed to tools. The part enters the work cycle with three ground faces, leaves it ready for assembly.

SNYDER

3400
E. LAFAYETTE

TOOL & ENGINEERING COMPANY

DETROIT 7,
MICHIGAN

28 Years of Successful Cooperation with Leading American Industries

Got a tough centerless stock removal problem?

Here's the grinding wheel that will absolutely solve it!

Plant after plant is discovering that the *smartest solution to tough stock removal problems in centerless grinding is a* CINCINNATI Grinding Wheel. Because CINCINNATI Wheels go hand-in-hand with centerless grinders.

And with a Cincinnati Milling-trained machinist on the job to help you get the most out of CINCINNATI Grinding Wheels, you can count on a quick answer to that tough stock removal problem.

Why are we so sure that we can help you? Well, there are three big reasons:

1 CINCINNATI Grinding Wheels are used by—and developed by—Cincinnati Milling, which has done more research, had more experience and made more centerless grinders than any other organization in the world.

Stock removal problem as tough as mastering a chip shot. Club heads came to grinder as rough forgings (unmachined). About .040" stock had to be removed from shaft end and shaft ground to a taper in one operation. See Case History (upper right) for solution.

2 We've solved hundreds of centerless grinding problems using CINCINNATI Grinding Wheels. These problems have not been confined to stock removal. They include a complete variety—such as roundness, taper, sizing and production.

3 CINCINNATI Grinding Wheels represent 25 years of Cincinnati Milling research and practical experience based on an entirely new approach to grinding wheels—the development of the grinding wheel as a true cutting tool.

We are so confident—so absolutely sure—that CINCINNATI Grinding Wheels can help solve your tough centerless problem that we make this *unconditional offer:*

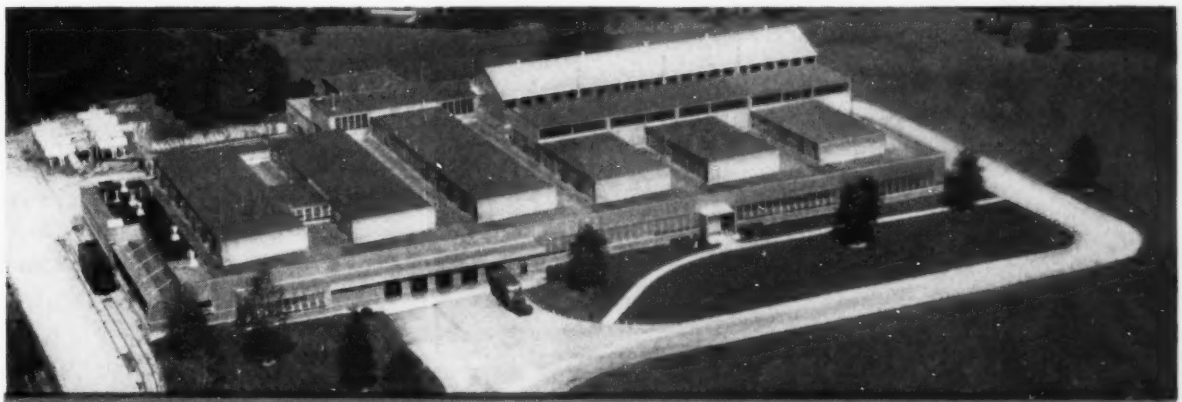
> Either you must be completely satisfied, or we will make no charge for the CINCINNATI Grinding Wheel used.

If you have a tough centerless problem, contact us at once. We'll send one of our expert machinists—men who are Cincinnati Milling-trained and know grinding and grinding machines as well as grinding wheels. He can show you how to get the most out of CINCINNATI Grinding Wheels and help you solve that tough centerless problem. There is no charge for the service of this expert machinist. Write, wire or phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

How
CINCINNATI Grinding Wheels
Solved Tough Centerless
Stock Removal Problem

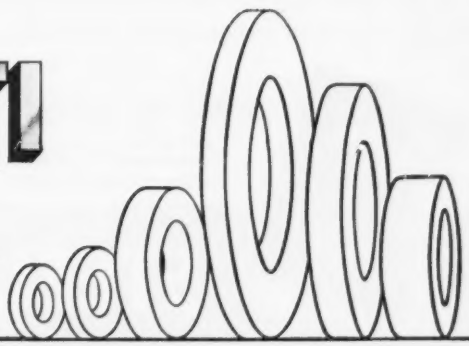
CASE HISTORY No. 712

The job	Grinding the shaft end of golf club heads.
The machine	Cincinnati No. 2 Centerless.
The problem	Stock removal. The heads come to the grinder as rough forgings (unmachined). About .040" stock must be removed and the shaft ground to a taper in one operation.
The solution	A Cincinnati 2A36-S6-VL wheel ground more than 25,000 parts -- 25-30% more than any competitive wheel had produced -- plus a 10% increase in parts per wheel dressing. Wheel size 20" x 2-1/2" x 12".



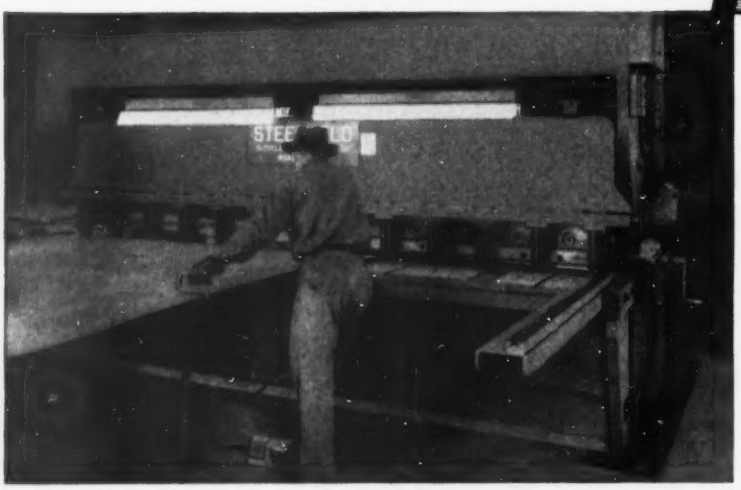
CINCINNATI GRINDING WHEELS are manufactured in this new, completely modern Cincinnati Milling plant.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



TOE CONTROL ELIMINATES KNEE ACTION

ELECTRIC FOOT SWITCH REDUCES FATIGUE - SPEEDS SHEARING



● The operator can slide the switch around the floor to wherever handiest to use. A mere touch of the toe and the knife is set in motion. Electric toe control is standard on all Steelweld Shears and furnished at no extra cost. It enables shearing speeds not attainable with ordinary foot treadles for many cutting operations.

● If you have spent a day at a shear with the old mechanical foot treadle, you know what knee action is. As the hours roll by it grows more and more tiresome, fatiguing, and production slips accordingly.

At last something has been done about it. Electric foot switches have been adopted as standard equipment for Steelweld Shears. Knee action has been replaced by fast easy toe control.

Toe control is one of many outstanding features you get on Steelweld Shears. These machines are in a class by themselves. Learn what they can do for you.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5414 East 282 St., Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS

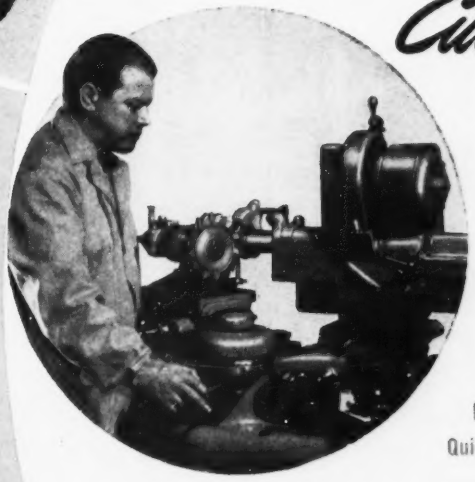
For more information on products advertised, use Inquiry Card, page 261

GIVE YOUR CUTTING TOOLS THE EDGE

WITH A

PRATT & WHITNEY

Cutter and Radius GRINDER

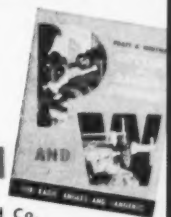


RADII, ANGLES or TANGENTS . . . STRAIGHT or TAPERED FLUTES . . . SQUARE, RADIUS or BALL ENDS — Grind Them Quickly, Economically, Accurately

Today's high speed machines require sharp, accurately ground cutting tools for efficient production. A Pratt & Whitney Cutter and Radius Grinder will give you longer tool life, faster stock removal and lower tooling costs.

Practically every type of cutting tool — stock or special — can be ground quickly and economically. Difficult jobs like grinding accurate ball and radius noses on end mills are handled with speed and ease. To assure flute uniformity and concentricity, all tools are ground from the shank — and not from centers.

The P&W Cutter and Radius Grinder is expertly designed for ease of operation and is ruggedly constructed of the finest materials for a long, accurate life under hard, constant use. Two sizes grind flute lengths up to 4½" and 10" respectively. Mail coupon for complete information.



PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

WEST HARTFORD 1, CONNECTICUT, U.S.A.

First Choice for *Accuracy*

PRATT & WHITNEY — Div. Niles-Bement-Pond Co.
12 Charter Oak Blvd., West Hartford 1, Conn.

Gentlemen: Please mail my free copy of the P&W Cutter and Radius Grinder Circular No. S-455-7.

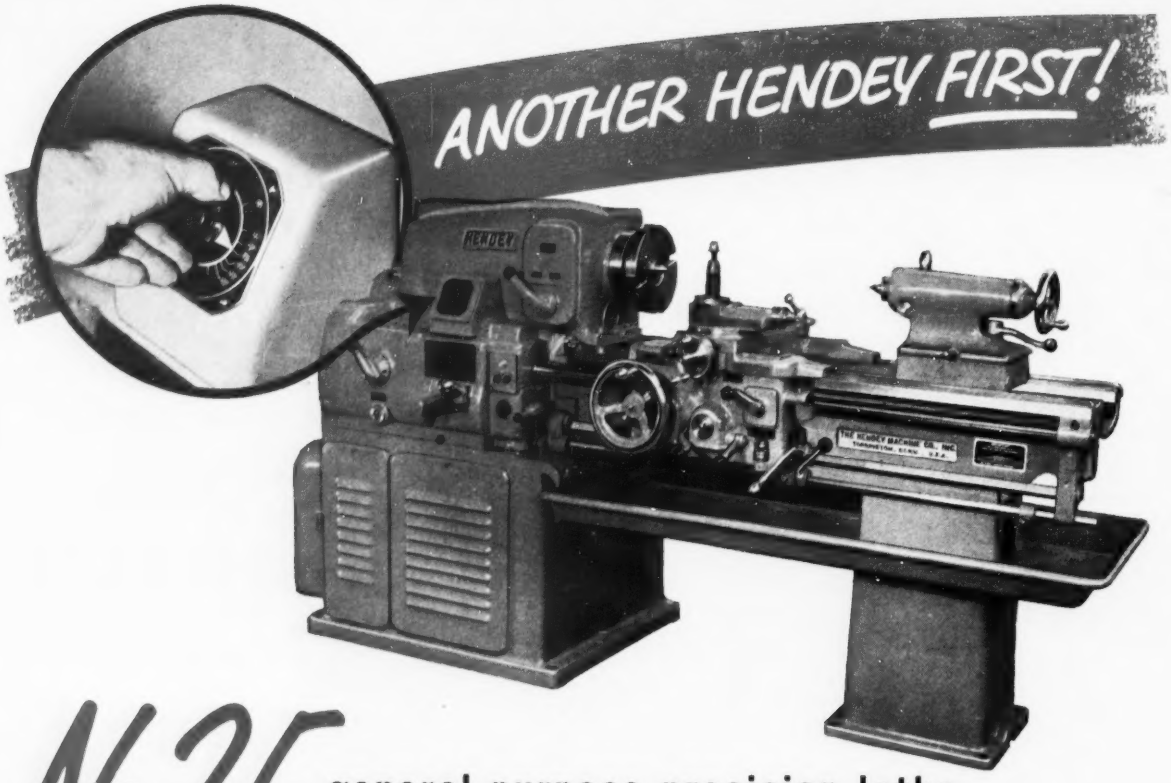
NAME _____

POSITION _____

COMPANY _____

CO. ADDRESS _____

CITY _____ ZONE ____ STATE _____



No. 2E general purpose precision lathe WITH ELECTRONIC MOTOR CONTROL

Hendey, pioneer in "quality," introduces another *first* — a new 14″ precision general purpose lathe with infinitely variable spindle speed control to 1500 R.P.M. Because of this outstanding feature the No. 2E offers broad opportunities to increase efficiency and lower turning costs, with operator effort reduced to a minimum.

Effortless control by one convenient fingertip selector smoothly adjusts spindle speeds through the full range from 15 to 1500 R.P.M. Adjust under cut or pre-set to the most efficient speed . . . it's that simple. The Hendey proved electronic control of the drive motor takes over the effort . . . responds to the operator's every spindle speed requirement. Instantaneous electric dynamic spindle braking plus start, stop, and reverse are one-lever controlled at the headstock and apron.

Add to this . . . induction hardened and precision ground bedways . . . reverse to the lead screw . . . automatic lubrication . . . 48 feed and thread changes . . . sturdy V-type cross ribbed bed . . . convenient grouping of operating controls . . . plus traditional Hendey built-in quality and precision.

Write for detailed specifications.

INFINITE NUMBER OF SPEEDS TO 1500 R.P.M.
FINGERTIP SINGLE DIAL SPEED CONTROL
SPEED SELECTION PRE-SET OR WHILE CUTTING
QUIET — SMOOTH DRIVE
INDUCTION HARDENED AND GROUND BEDWAYS
PRECISION BUILT

the Hendey machine co., inc.
torrington, conn., u.s.a.
——precision machine tools——

HENDEY

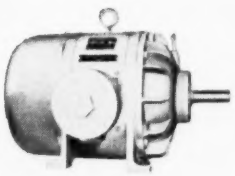
distributors in principal cities

For more information on products advertised, use Inquiry Card, page 261

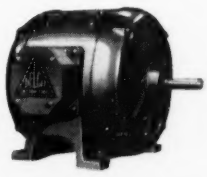
DEPENDABILITY...

that minimizes costs

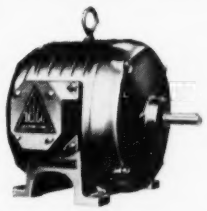
Delco Motors



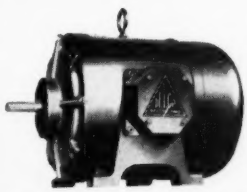
Explosion-proof motor



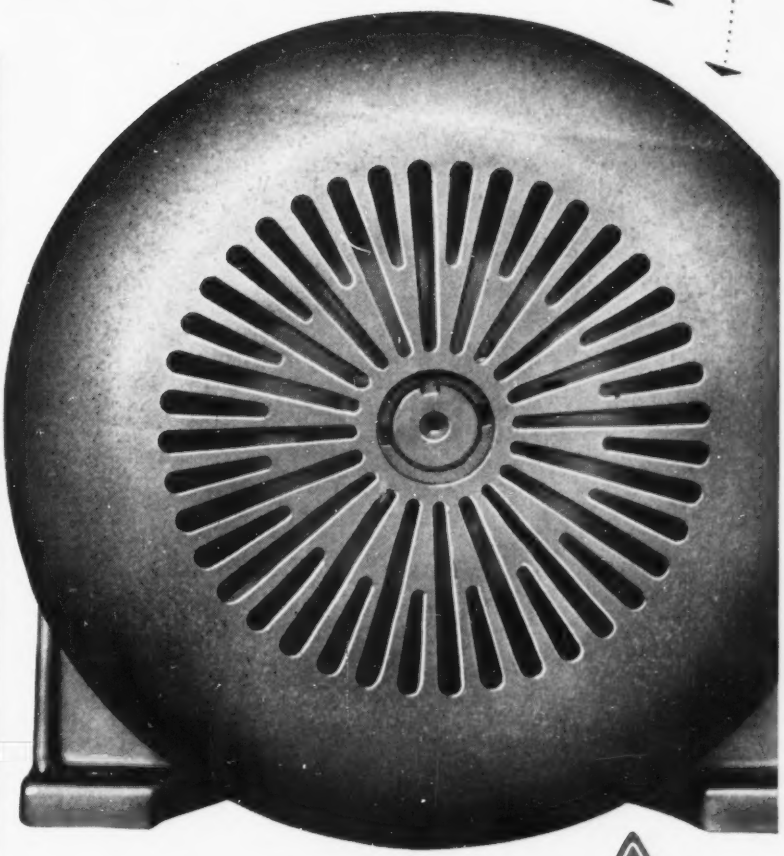
Open ball-bearing motor



Totally enclosed ball-bearing motor



Totally enclosed fan-cooled motor



With Delco integral motors on your machines you have a cost factor on which you can depend.

For Delco designs and builds with one idea in mind—to produce motors that will run dependably, under extreme conditions, for record-breaking periods of time.

Put your trust—and your motor dollars—in Delco motors . . . your nearest Delco sales office will help you with all details.

DELCO DAYTON OHIO

DELCO PRODUCTS

Division of General Motors Corporation
Dayton, Ohio

SALES OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis • San Francisco

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HERE IS FLEXIBILITY

ALL MACHINING on Eight Sizes MOTOR FRAMES

Completed on NATCO Machines

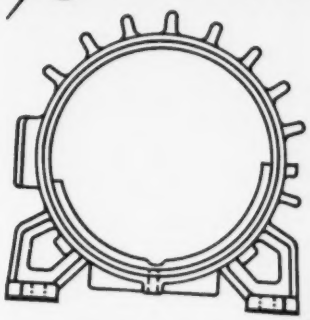
- **MILLED**
  - FEET PADS
- **DRILLED**
  - 3 HOLES AND COMB. DRILL & REAM 2 HOLES
- **ROUGH BORED**
  - 3 DIAM. UP TO 14½" BOTH SIDES
- **ROUGH FACED**
  - BOTH SIDES
- **FINISH BORED**
  - 3 DIAMETERS BOTH SIDES
- **FINISH FACED**
  - BOTH SIDES
- **DRILLED**
  - 4 END HOLES BOTH SIDES
- **TAPPED**
  - 4 END HOLES BOTH SIDES

Additional holes not shown but completely drilled and tapped are the specification plate holes, eye bolt hole and conduit box holes.

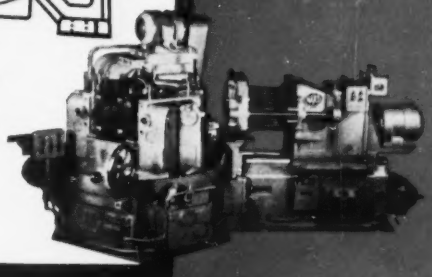
NATCO ENGINEERED
for quality and quantity production

8 SIZES

MILL & DRILL 48 MOTOR FRAMES PER HOUR

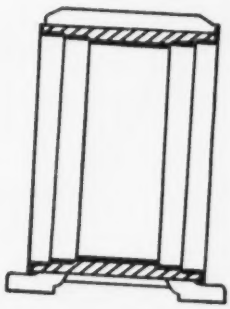


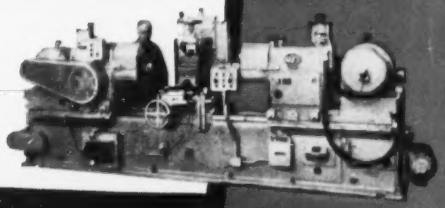
MILL 4 FEET PADS
DRILL 3 HOLES
COMB. DRILL AND
REAM 2 HOLES



8 SIZES

BORE TO 3 DIAMETERS AND FACE BOTH SIDES 31 MOTOR FRAMES PER HOUR





Call a Natco Field Engineer
to help you solve your problems in
Drilling, Boring, Facing and Tapping.

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices | CHICAGO, 2009 Engineering Bldg. • DETROIT, 409 New Center Bldg.
BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon

DOUBLE CIRCLE TOOLS

HAVE BOTH

endurance

AND

accuracy

It takes both to produce quality tools . . . for each is dependent upon the other to give trouble free performance.

CHICAGO-LATROBE makes sure that the complete line of Double Circle Tools has both *endurance* and *accuracy*. It is a result of high quality CHICAGO-LATROBE standards . . . with each manufacturing step carefully checked . . . and the finished product scientifically inspected by experienced craftsmen to insure *precision* tools.

To back up CHICAGO-LATROBE'S determination of maintaining its enviable reputation for leading quality, every fifth employee is a qualified inspector. No finished tool can escape these skilled inspectors without having the qualities of both *endurance* and *accuracy*.

To insure low yearly tool costs it will pay you to specifv DOUBLE CIRCLE TOOLS.

ORDER FROM YOUR INDUSTRIAL DISTRIBUTOR

DOUBLE CIRCLE TOOLS

CHICAGO-LATROBE

411 W. ONTARIO ST. CHICAGO 10

DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • CARBIDE TOOLS • SPECIAL TOOLS

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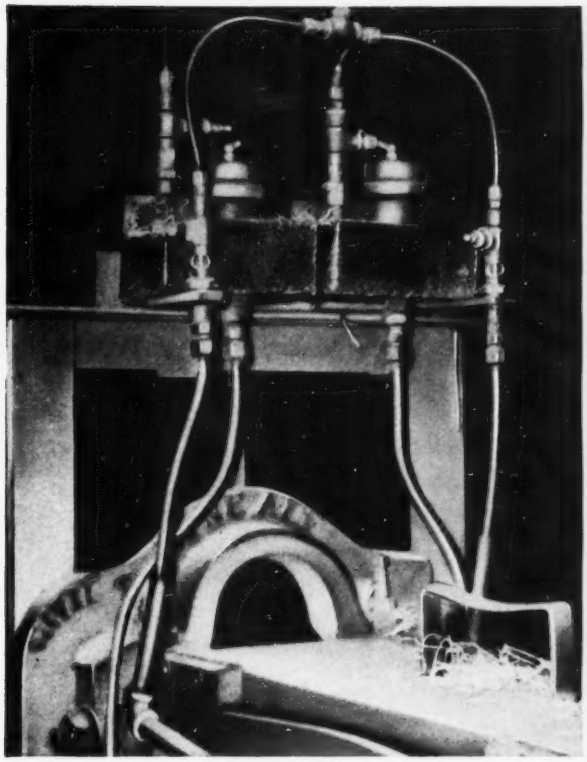

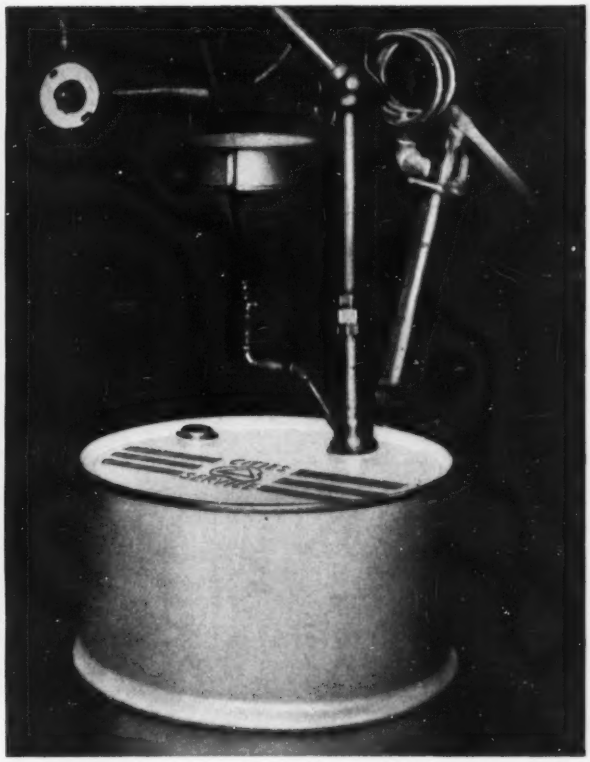

CENTRALIZED LUBRICATION SYSTEM proves to be time and money-saver for American Excelsior Company. Drum of lubricating oil is connected to main supply line which feeds oil to each machine by means of main pump and individually adjusted oilers.

Cities Service Raven Oils Fight Fire Hazard for American Excelsior

CENTRALIZED LUBRICATION SYSTEM WITH CITIES SERVICE RAVEN OILS WORKS FOR WISCONSIN COMPANY!

Like so many other alert manufacturing organizations, American Excelsior Company, Oshkosh, Wisconsin, relies on a centralized lubricating system for most effective and economical lubrication in their operation. (See picture caption.)

And another great time and money saver has been the Cities Service Raven Oils they use. In an excelsior operation, fire is a major hazard, but with Raven Oils, (high flash point) American Excelsior gets maximum lubrication AND maximum protection against fire!... *Another outstanding example of how Cities Service lubricants can solve complicated lubricating problems.*

Perhaps you have a particularly bothersome lubricating problem. Why not turn it over to a Cities Service Lubrication Engineer for the answer that will mean money and time saved for you? Contact the Cities Service office nearest you, or write Cities Service Oil Company, Dept. K 12, Sixty Wall Tower, New York 5, New York.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

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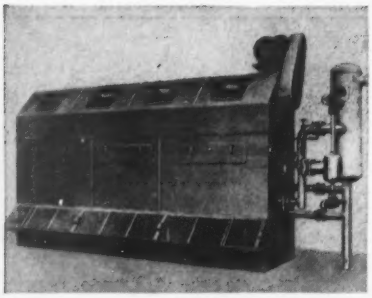
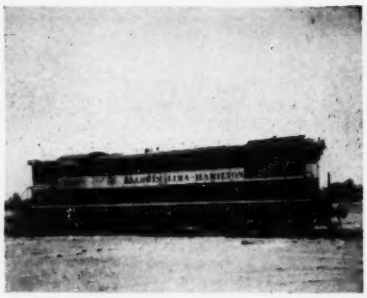


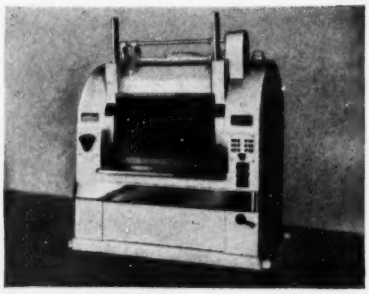
INDUSTRIAL AIR CONDITIONING UNITS
York Corporation
York, Pa.



LOCOMOTIVE PARTS
Baldwin-Lima-Hamilton
Corp., Eddystone, Pa.

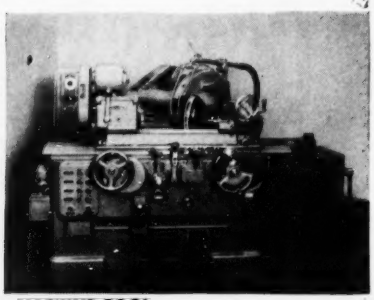
You too can eliminate layout and set-up and reduce handling time with a WIEDEMANN TURRET PUNCH PRESS

TRUCK COMPONENTS
The Autocar Company
Ardmore, Pa.



BAKERY MACHINERY
Baker Perkins, Inc.
Saginaw, Mich.

INDUSTRIAL TRUCKS
Automatic Transportation
Company, Chicago, Ill.



MACHINE TOOL COMPONENTS
Norton Company
Worcester, Mass.

These are just a few who do!

ASK FOR A TIME STUDY

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

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"STANDARD for tough jobs since 1881"

Red Shield says:

Call your Industrial Supply Distributor for Shield Brand Taps.

Specialized factory service available everywhere.

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

If you're in the market for special machines or special tooling...

Kearney & Trecker Special Machinery Division—an old hand in the business—has a brand new plant and greatly expanded facilities to build the big or small special equipment you need

THOUGH we've designed and built up to $3,000,000 worth of special machinery annually . . . have been in the field since 1898 . . . . we've never publicized the fact till recently. Limited production facilities prevented taking additional orders.

But now we have a new plant built exclusively to produce special machines, special tooling and special adaptations of standard equipment. This plant, with approximately 200,000 sq. ft. of floor space, is equipped with more than $2,500,000 worth of the very latest tools and equipment. It's at your service.

We've worked with the best of them

In practically every industry . . . automotive, shoe machinery, aviation, etc. . . . there have been many installations of Kearney & Trecker special machines. These machines were custom-built to solve unusual metalworking problems. They provide extremely high production even with exacting dimensional accuracy and fine surface finish requirements.

We're staffed with engineers who have learned the business from the ground up

Our Special Machinery Division engineering section has almost 100 widely-experienced design, project and production engineers. These men are up-to-the-minute on the latest developments in applied mechanics, hydraulics, electronics, metallurgy and allied fields. They know exactly how to utilize these advances in the design and construction of outstanding special machine tools. In addition, it has a full complement of experienced machinists and mechanics needed for special machine construction.

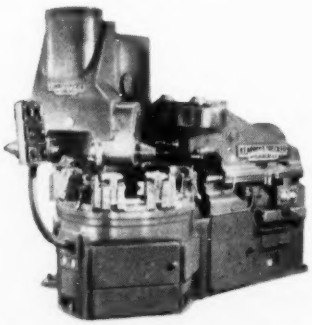
Every special machine is backed by the entire Kearney & Trecker organization

The Special Machinery Division is an integral part of Kearney & Trecker, a corporation that does an annual business in excess of $25,000,000. Every product, every commitment we make, is fully backed by our reputation for quality, cooperation and ability to live up to promises. Every machine is designed, then built, to your specific requirements with ample reserve for emergencies.

We invite your inquiry

We'll be glad to provide you with any information we can . . . including sample machine specification sheets on typical installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service. Furthermore, if you have special production machinery problems, have one of our senior Project Engineers analyze them, without obligation, of course.

Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



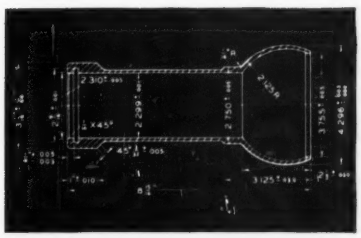
We've built special machines or adaptations of standard equipment for practically every industry. Here is a photo of a three-station rotary indexing machine we designed and built for a major automotive manufacturer.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 261

Gift Wrapped-

A Customer's Job-Proved View of the Mona-Matic



BALL HOUSING (left): Fabricated steel. Turn ball and opposite end diameter; bore and form internal groove. Limits ±.001". Replacing battery of 4 machines, Mona-Matic raised production from 150 to 260 parts per day. **SLEEVE** (right): Steel. Bore and internal chamfer both ends. Production increased from 20 to 70 parts per hour.

Gift? Here are the facts, the job and the results. You decide what you'd think, if it were your job!

The National Machine Works, Oklahoma City, produces a fine drive shaft housing repair kit, consisting of a steel sleeve and ball housing (see details, left). Previously, 4 machines—4 operators—were required.

Now, thanks to the Mona-Matic's built-in gift for boosting output (plus savings on setup, form tools, tool change and grinding) this happy user is not only handling production with *one* machine, but has also materially increased production. If that doesn't strike you as a gift, consider this fact—this Mona-Matic, not even operating full time, has *paid for itself in less than one year!*

The Monarch Mona-Matic, briefly, is a fully automatic cycle, high-speed, Air-Gage Tracer controlled, single running tool turning machine —easily set up, extremely accurate, with infinite feed range and integrated rear carriage. It is furnished in a variety of versions, all proved in both long and short runs.

We've prepared Booklet #1805 giving the full story of the Mona-Matic—complete with data, specifications and many other job reports. Even if you don't believe in gifts, there's no time like the present! Write now . . . *The Monarch Machine Tool Company, Sidney, Ohio.*

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

Use our CYLINDRICAL GRINDING

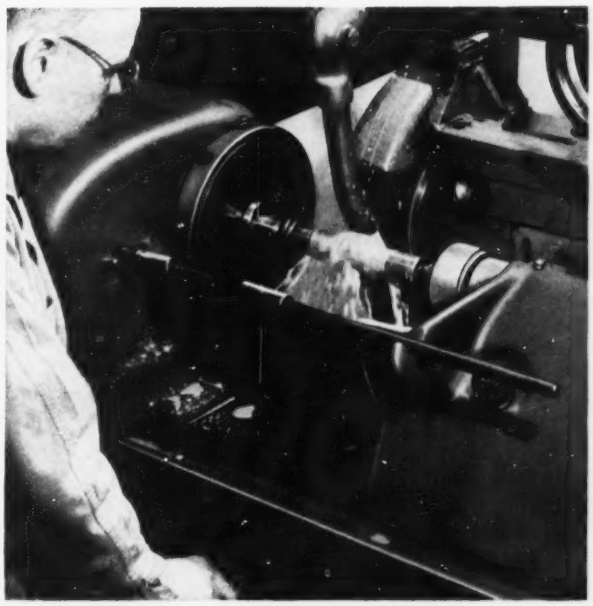
CARBO

REGISTERED

WHEELS on your job

...see *proof* that the right grinding wheel improves quality...boosts production...cuts costs

Make an *on-t'he-job* comparison of CARBORUNDUM's cylindrical grinding wheels with the wheels you're using now. Compare them for speed and accuracy of cut...for cool cutting action...long wheel life...economy. Find out what the *right* grinding wheel by CARBORUNDUM does for you—on your plain, universal, or special-purpose cylindrical grinder.



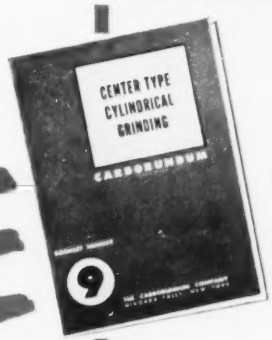
HOW TO CHOOSE THE RIGHT WHEEL

Your CARBORUNDUM Salesman or Distributor is the man to call. He'll visit your plant, analyze each part of your cylindrical grinding operation—your machines...the material you're grinding...your tolerance and finish requirements...the production rate you're after. Then he'll recommend the *right* combination of abrasive grain, grade, structure and bond—all engineered by CARBORUNDUM into a precision grinding wheel designed to give you the exact results you're looking for...the wheel which will give you highest output at lowest cost.

MAKE THE TEST TODAY—DECIDE FOR YOURSELF!

Call your CARBORUNDUM Distributor or Salesman. He's listed in the yellow pages under "Abrasives" or "Grinding Wheels." He's your best bet for experienced counsel ...and for prompt delivery from complete stocks...for every grinding job you do.

Get this helpful booklet FREE



THE CARBORUNDUM COMPANY, Dept. MM 81-321
Niagara Falls, New York

Please send me your booklet, "Center Type Cylindrical Grinding."

NAME _____ TITLE _____

STREET & NO. _____

CITY _____ ZONE _____ STATE _____

☐ Also send: Catalog No. 50—"Grinding Wheel Selector."
☐ New Simplified Basic Prices of Grinding Wheels.

RUNDUM

TRADE MARK

...the ONLY source for EVERY abrasive product you need

81-321

...with TYCOL lubricants on hand!

A Cutting Oil with a "Delicate" Touch! Screw threading to fine tolerances is the acid test of any cutting oil . . . one reason why we ask: can your present oil measure up to Tycol Angrove 40? Take the customer who was threading ⅜" standard threads on 303 Stainless . . . with thread extending to the head . . . and the overall job calling for an extremely fine finish. The best of the competitive oils used yielded only 600 pieces before serration and burring appeared, necessitating regrinding the chaser. Tycol Angrove 40 produced some 4,500 pieces with no defects apparent under magnification . . . and with no regrinding of the chaser throughout the entire run! If you can't top this – contact your local Tide Water Associated office for further information!

Over 300 Tycol industrial lubricants are at your disposal . . . engineered to fit the job!

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
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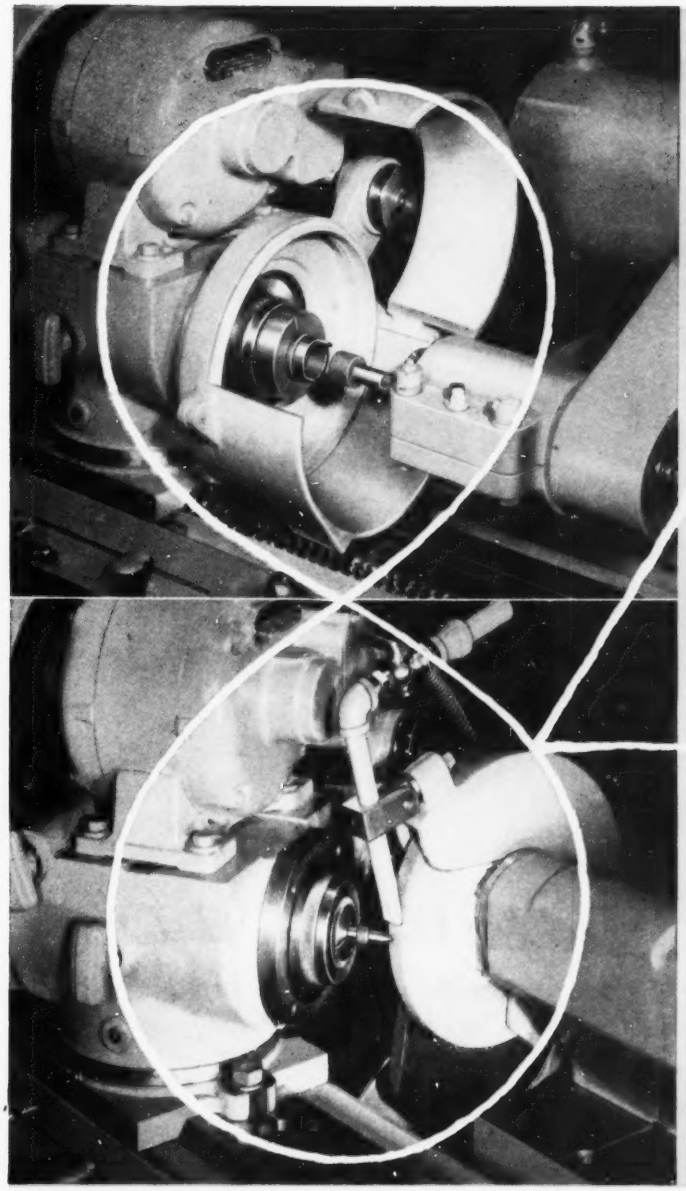
TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL . . . THE WORLD'S MOST FAMOUS MOTOR OIL

For more information on products advertised, use Inquiry Card, page 261



RIVETT

MODEL 84

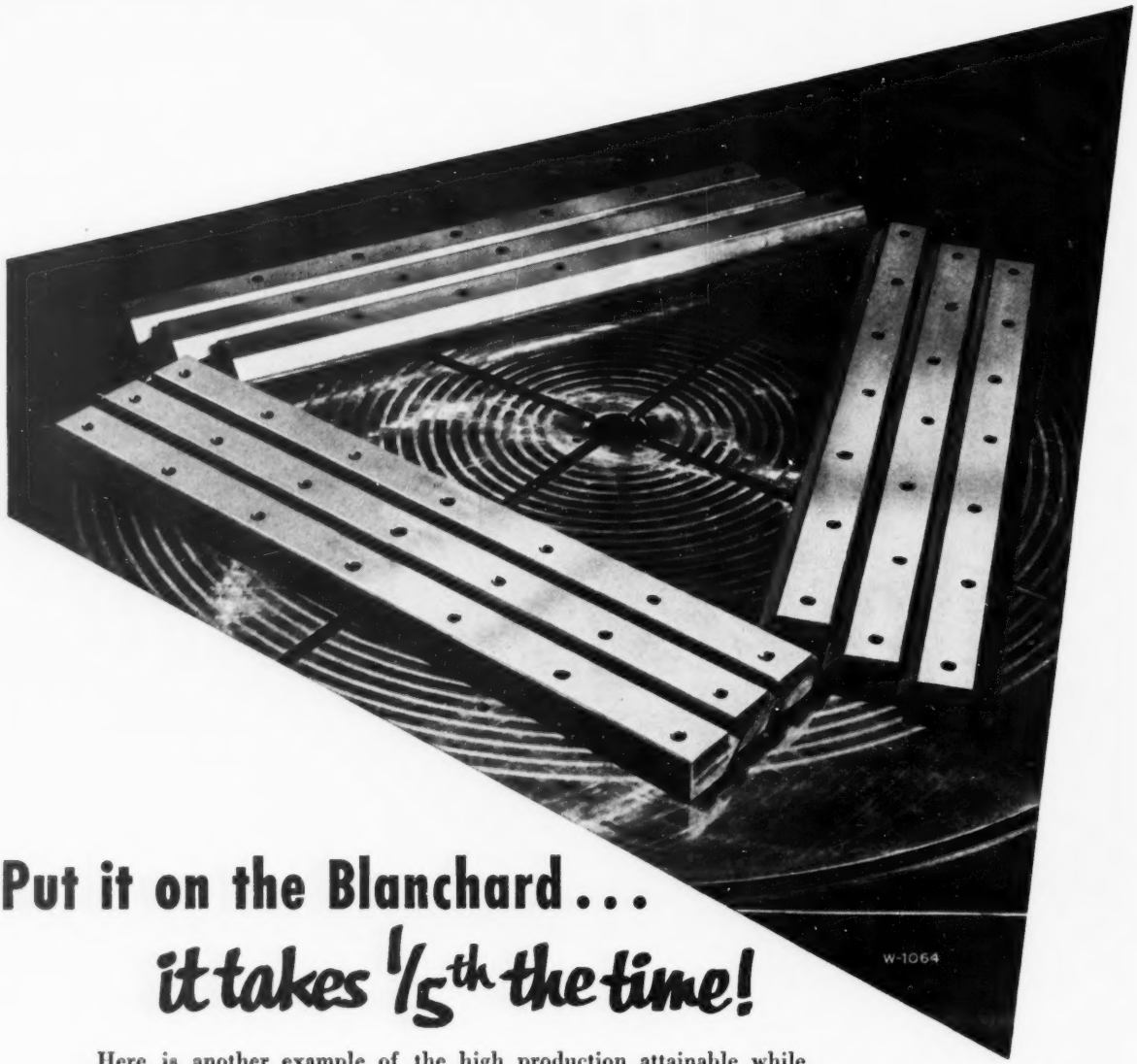
INTERNAL-EXTERNAL GRINDER

This small hole grinder mounts interchangeable wheelheads for internal and external spindles. Hole capacity is 3" dia. with a maximum depth of 4"; external is to 3" dia. by a 4" length. Collets and step chucks mount directly in lathe-type spindle.

This flexibility combined with the inherent accuracy is why the Rivett 84 has gained great popularity in toolrooms since its introduction to the trade twelve months ago.

Quick and easy to set up, the 84 will handle your diversified jobs faster, too. All the details to prove this are shown in Catalog No. 84-A. **Write for a copy today!**

RIVETT LATHE & GRINDER, INC., DEPT. MR-11, BRIGHTON 35, BOSTON, MASS.



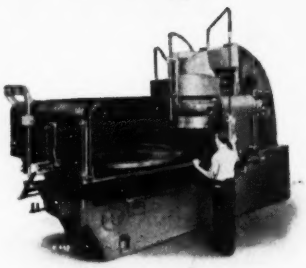
Put it on the Blanchard...
it takes 1/5th the time!

Here is another example of the high production attainable while grinding to extremely close tolerances with Blanchard Surface Grinders and Blanchard Wheels.

It formerly took 45 hours, floor-to-floor, to grind these nine hardened steel machine tool ways. They are 2½" x 3½" x 50" and hardened to Rockwell C-60-63.

Now, these highly desirable results are obtained, using a No. 42-72-84 Blanchard Surface Grinder — nine are placed on the chuck and ground on 6 sides, removing .015" from each surface, parallel to .0001", flat within .0001" with surface finish of 5 micro-inches. The Blanchard **cut time to 9 hours,** floor-to-floor!

No wonder production men say: "Put it on the Blanchard — it takes less time to do a better job".



This is the largest Blanchard Surface Grinder, No. 42-72-84.

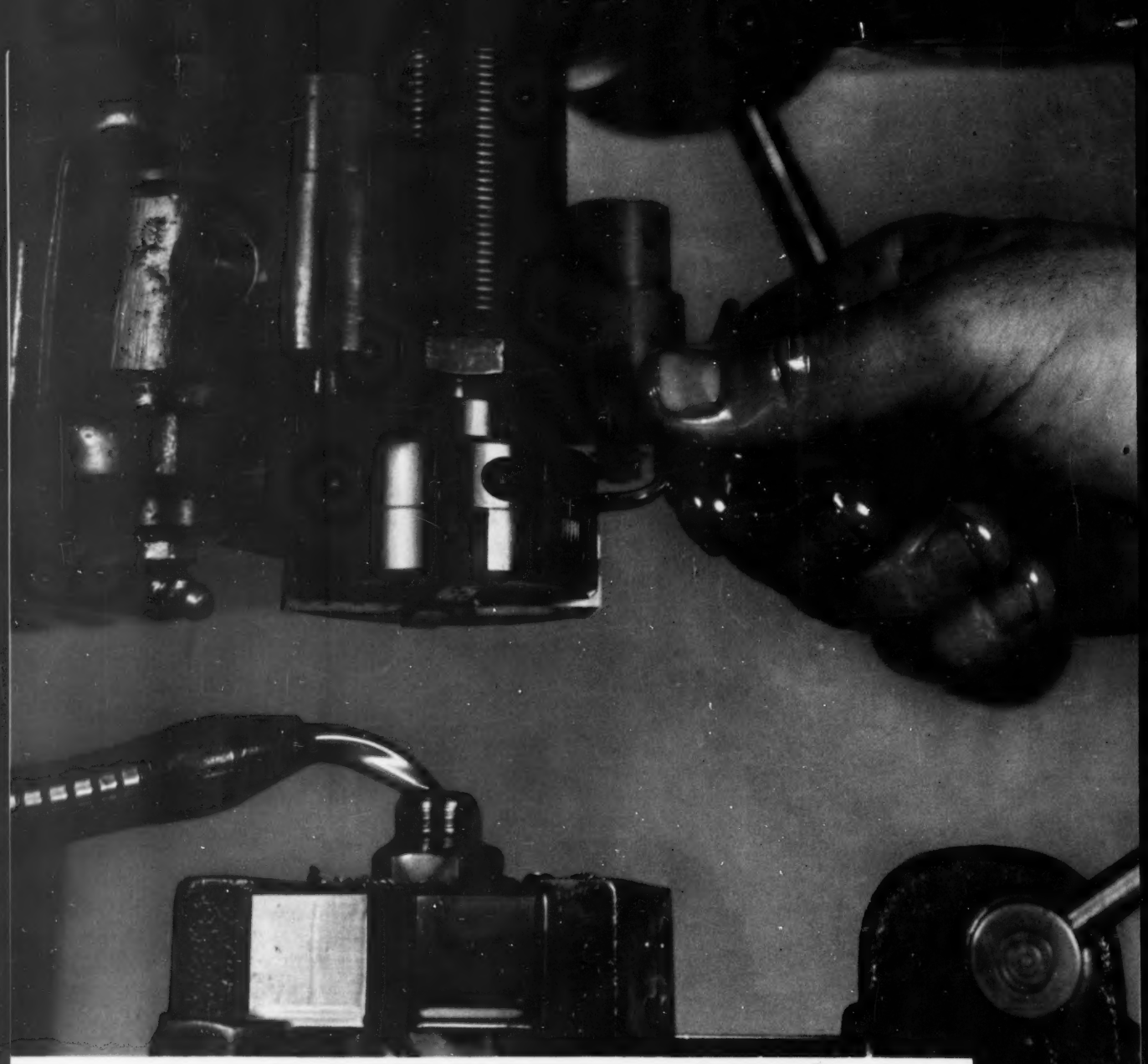
Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

For more information on products advertised, use Inquiry Card, page 261

SCENE 96:
"Accuracy Counts!"
... an actual scene from the GTD-Greenfield sound film "FACTS ABOUT TAPS AND TAPPING"
VOICE: "Good gaging technique is essential to insure interchangeability of threaded parts ... Here we see a plug gage used to make sure that threads are held within the GO and NOT GO limits set by the designer ... It pays to use guaranteed accurate gages ... Remember, a poor gage that rejects good products is an expensive tool."
GREENFIELD
TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
This 26-minute full-color motion picture "FACTS ABOUT TAPS AND TAPPING" is now available for group showing through your local GTD-Greenfield distributor.



CLOSE-TO-SHOULDER THREADING . . WITH REGULAR CHASERS!

Style DJ Solid Adjustable GEOMETRIC Die Head is compact and very short — designed to swing in limited tooling space. What's more, it has no face plate, so that regular chasers protrude enough to permit close-to-shoulder threading.

This handy die head permits quick adjustment to decimal sizes and various classes of threads. Chasers may be changed for different diameters and pitches too! The DJ head is ideal for short-length threading where quick back-off eliminates need of a self-opening head. Twelve sizes cover #0 to 6″ diameter range.

Write for full details. Specify Bulletin DJ

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

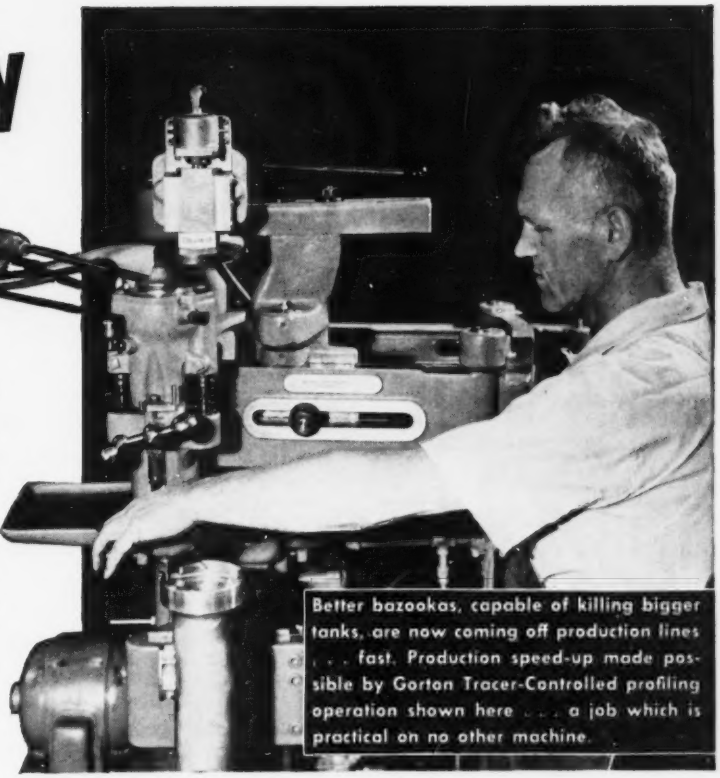
NEW HAVEN 15, CONNECTICUT

GEO MET RIC

Pantography at Work!

★

Inside profiling operation produces more than 36 pieces per hour with Gorton Tracer Control. Approximate time by the next best method . . . one piece every two hours.



Better bazookas, capable of killing bigger tanks, are now coming off production lines . . . fast. Production speed-up made possible by Gorton Tracer-Controlled profiling operation shown here . . . a job which is practical on no other machine.

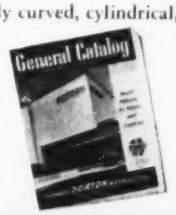
GORTON

- **IMPROVES QUALITY**
- **INCREASES PRODUCTION**
- **CUTS COSTS**

On many all-but-impossible jobs, Gorton Tracer-Controlled Pantographs and Duplicators speed up production on military or industrial contracts. High surface finish results from spindle speeds up to 45,000 R.P.M. Accuracy results from the use of over-size masters, patterns, or templates together with the reduction ratio which is exclusively characteristic of the pantograph. Whether a dozen or a thousand pieces, each is identical to the first. Work piece size varies from instrument parts to areas of 10 by 20 feet.

Gorton tracer-controlled equipment quickly pays for itself in profiling, routing, die sinking, mold cutting, counterboring, chamfering, grooving, graduating, engraving as well as many other standard or special operations on ferrous or non-ferrous metals and plastics where work is flat, uniformly curved, cylindrical, spherical or irregular in shape.

Mail the coupon below for General Catalog illustrating the complete Gorton line.



PRODUCTION DATA—

JOB: Profile 6 locking lugs for male and female sections of new 3.5" Bazooka.

MATERIAL: Aluminum alloy.

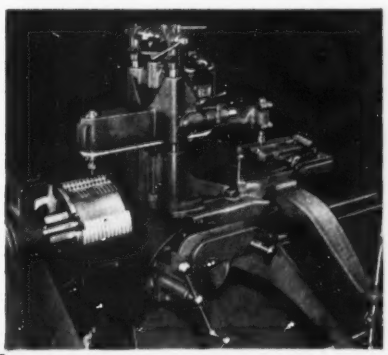
CUTTER: 5/32" dia. single flute, fast spiral H.S. steel running at 3,900 R.P.M., without coolant.

MASTER: 2 masters: one for male and one for female sections; 3 times oversize, traced manually.

HOLDING FIXTURE: Pneumatic-operated internal expanding type.

APPROX. TIME: 36 pieces per hour.

ALTERNATE METHODS: None practical.



THIS OPERATION SPEEDED UP 6 TIMES

Gorton Tracer Control chamfers ends of interrupted threads in breech ring and on breech block of 155 mm. gun. Previous time, 4 hours; Gorton time, 40 minutes.

GEORGE GORTON MACHINE CO.

1311 RACINE STREET **RACINE, WIS., U.S.A.**

Please send at once complete information about the Gorton line contained in Bulletin 1655- 1311.

Firm .....

Name .....

Title .....

Address .....

City, State .....

Half mile of HELIARC TRADE MARK welds OK'D by rigid X-ray tests

A midwest manufacturer was faced with the problem of getting X-ray quality welds in aluminum vessels. These welds were subject to pressure and had to be entirely free from porosity and oxide inclusions. After thoroughly investigating customer specifications, LINDE's service engineers recommended HELIARC inert gas shielded welding for the job.

Since then, about a half mile of these HELIARC welds have been OK'd by 100% X-ray inspections. According to company officials, HELIARC welding was "perfect for the job" and meant real savings by getting X-ray quality welds the first time without expensive rejections or repairs.

Whether you weld aluminum or other hard-to-weld metals, you, too, will find that fast, clean, HELIARC welding will save you time and production costs. HELIARC welding takes place under a shield of inert argon gas which eliminates the need for flux. As a result, HELIARC welds are free from porosity and oxide inclusions. This means fewer rejects and lower finishing costs. In fact, spatter-free HELIARC welds in many cases can be left "as welded."

You owe it to yourself and to your Company to find out more about the cost saving benefits of HELIARC welding. Call your local LINDE representative today. He will be glad to furnish you with detailed information on HELIARC welding.

LEFT Welding heavy aluminum sections with HELIARC *HW-10 torch. These welds were strong, dense, and required little finishing. BELOW The 300 amp.* HELIARC *torch has all-internal water-cooling of both torch head and power cable for cool, long-lasting operation. The HW-10 also features quick electrode adjustment.*

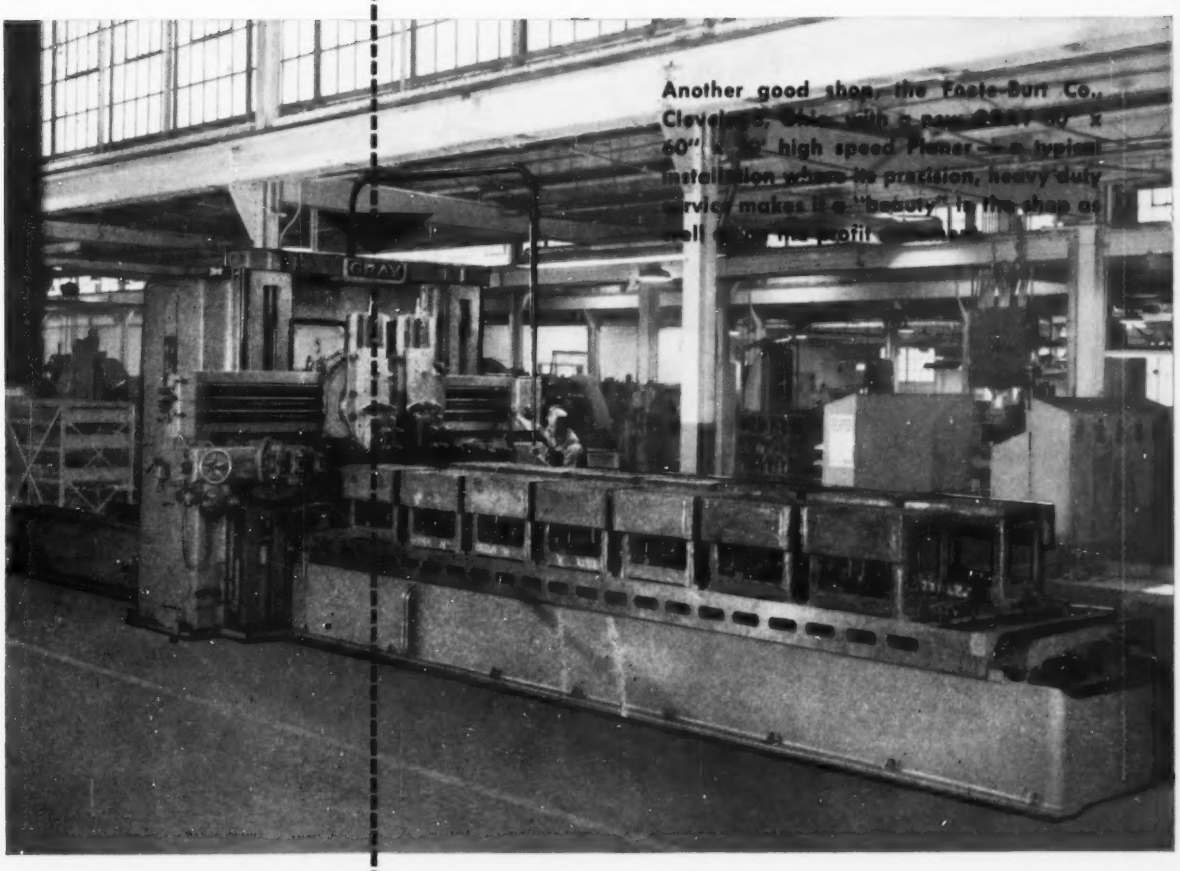
Linde TRADE-MARK

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 E. 42nd St., New York 17, N.Y. UCC Offices in Principal Cities
In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

"Heliarc" and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

For more information on products advertised, use Inquiry Card, page 261

the sign of a good shop



Another good shop, the Easte-Burt Co., Cleveland, Ohio, with a new GRAY 60" x 60" x 20' high speed Planer — a typical installation where its precision, heavy duty service makes it a "beauty" in the shop as well as [illegible] profit.

a new **GRAY** planer

. . . recognized by machine shops throughout the world as the ultimate in planers. Built for high production with great precision, combining more original engineering developments and production features than any other planer . . . it is in such demand that GRAY is the largest planer builder.

Write today. Get the story on GRAY

HIGH
low cost
PRODUCTION

Dept. B

The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

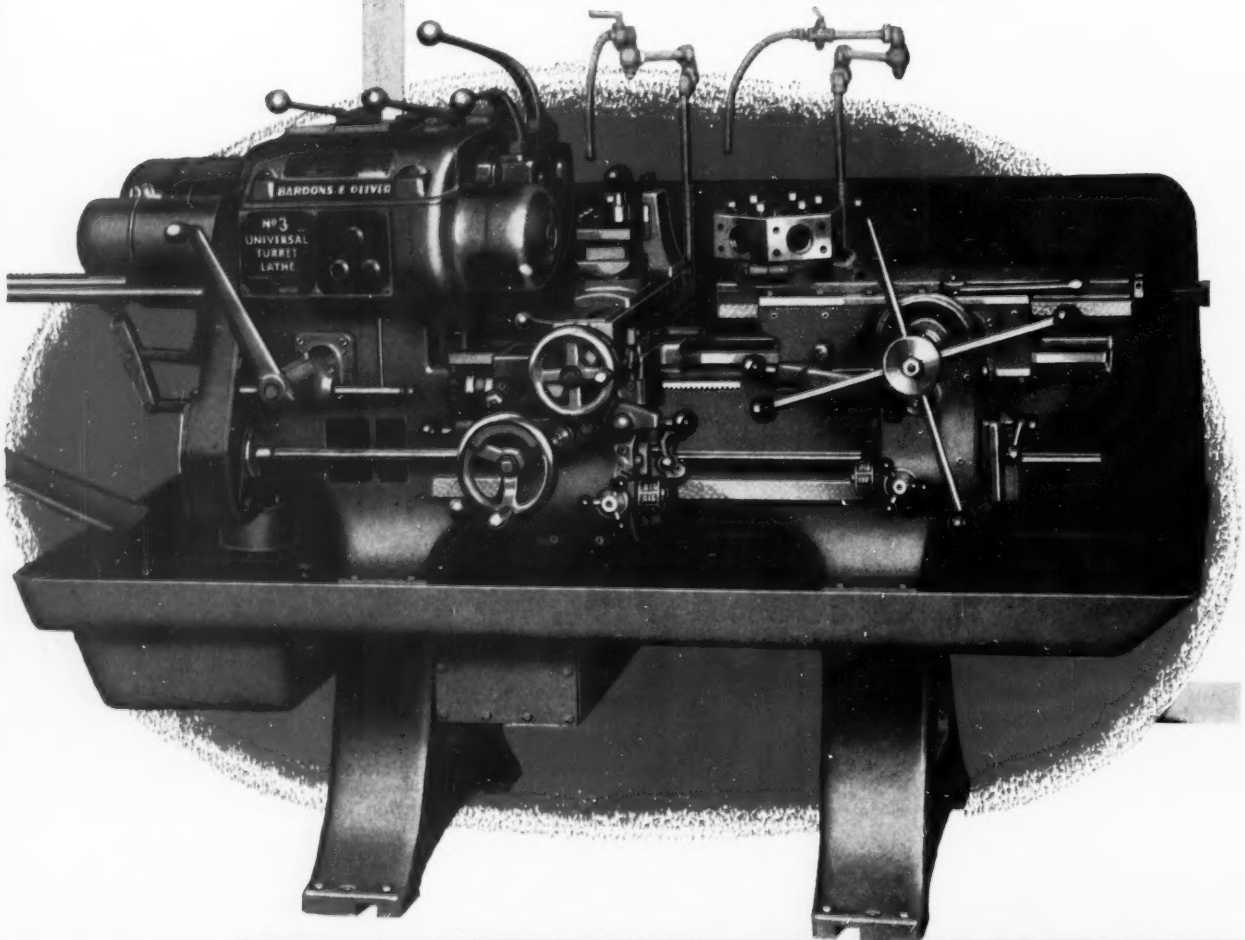
CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

New... BARDONS & OLIVER No. 3 TURRET LATHE...

★ 25% higher speed

★ 50% more power

★ 100% increased rigidity



BARDONS & OLIVER, INC.

1135 WEST 9TH STREET · CLEVELAND 13, OHIO

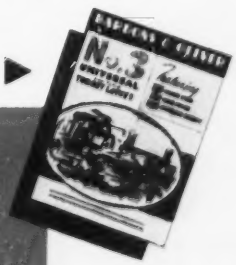
Featuring!

- √ 1825 R. P. M. Spindle Speed
- √ Unequaled Rigidity of "X" Type Cross Ribbing over Full Length of Bed
- √ 100% Anti-Friction Bearing Headstock
- √ Single Lever Feed Selectors for both the Hex Turret and Universal Carriage
- √ Alloy Bronze Anti-Backlash Nut on Cross Slide Screw
- √ "One-Shot" Lubrication of all Tool Slide Ways
- √ Flange Type Motor Mounting that Eliminates all Belts and Pulleys
- √ Hardened and Ground Steel Turret Slide and Saddle Ways, Gibs and Caps
- √ 7½ H. P. available at each one of 12 Geared Spindle Speeds
- √ Instantaneous High-Low Speed Change through Double Multi-Disc Clutch
- √ Replaceable Bed Ways of Solid Hardened and Ground Alloy Steel
- √ Large Hardened and Ground-in Thread Ball Bearing Cross Slide Screw
- √ Sealed Carriage and Saddle Aprons
- √ Improved Square Turret, Designed and Built for Lifetime Accuracy
- √ Impeller Type Coolant Pump with Individual Motor Drive
- √ Optional Collet Chuck Capacities (1½" or 2")

Specifications!

Swing Over Bed	15½ inches
Swing Over Guides	13¾ inches
Swing Over Cross Slide	7⅝ inches
Collet Chuck Capacity	1½ or 2 inch round
Hexagon Turret Travel	10 inches
Cross Slide Travel	9 inches
Carriage Longitudinal Travel	18½ inches
Turret and Carriage Power Feeds with Single Lever	6
Number of Speeds with Single Speed Motor	12
Motor Horse Power	7½
Net Weight With Cabinet Motor	3050 pounds
Net Weight With Flange Motor	2850 pounds

SEND FOR NEW NO. 3 CATALOG ▶



MANUFACTURERS OF A COMPLETE LINE OF
TURRET LATHES AND CUTTING OFF LATHES

KRW PRESS PRODUCES 200-250 PIECES PER HOUR-12 HOURS A DAY FOR 2½ YEARS!

AND IT'S STILL GOING STRONG!

The headline tells the story! What more can we say? This KRW 150-ton Hydraulic Press is a mighty valuable piece of equipment at Liberty Steel Chest Corp., Rochester, N.Y. It's a motor-driven, 2-cylinder Press used for forming and deep-drawing work on tool and tackle boxes and roaster parts. Here is one more example of the rugged service and versatility you get in KRW Hydraulic Presses.

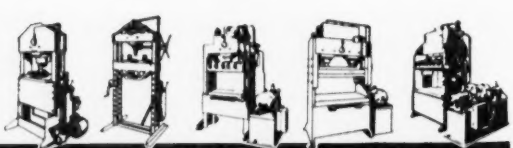
Let KRW help you with your pressing problems. Our engineers can show you how to save time and money in your shop with a KRW Hydraulic. We have a complete line of one, two and three cylinder models; 25-150 Ton capacities; hand, air or motor driven. KRW Presses are all self-contained above ground and give you maximum tonnage at any part of the stroke.

• Write for free illustrated brochures with detailed specifications and prices. Dep't. 15.

Maximum size Bed and Platen on 100 and 125 ton models—40" x 60"; on 150 ton models—36" x 60". For facts, prices and delivery dates see your Machinery dealer or write, wire or phone Dep't. 15

K·R·WILSON

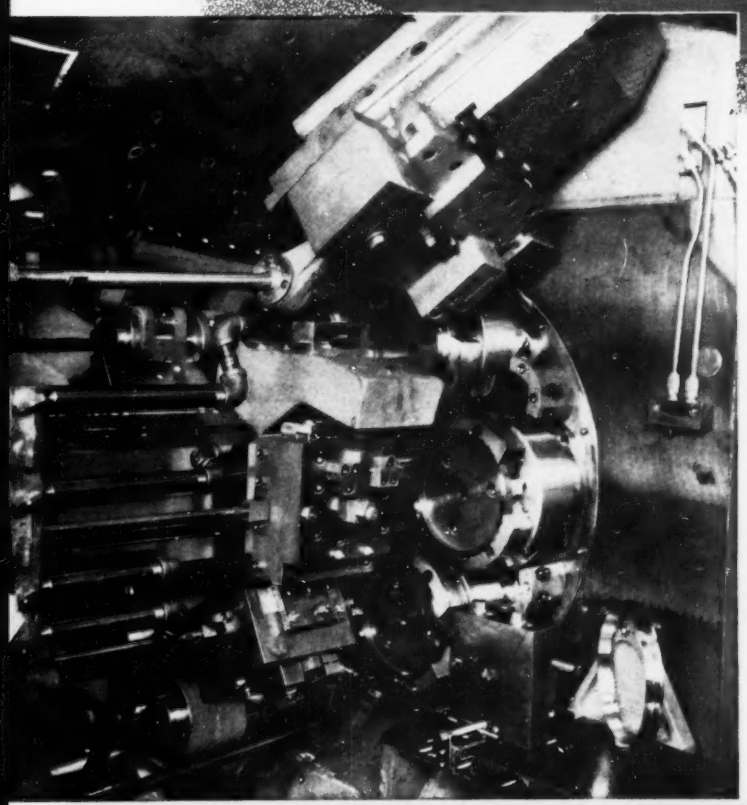
215 MAIN ST., BUFFALO 3, N. Y.



Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!

For more information on products advertised, use Inquiry Card, page 261

ACME-GRIDLEY CHUCKERS take the TOUGH JOBS



This 8" Combustion Chamber Flange for jet engines is no job to be fooled with.

Machined from 8" diameter stainless steel blanks as shown, it presented first the problem of removing a lot of metal FAST—321 stainless is a difficult metal for precision results.

Tooling for accuracy and finish included both roughing and finish taper turning and boring attachments for the special angles and for holding the thin wall within .008 without danger of collapsing the piece.

All 13 operations were performed on the 10" Acme-Gridley Model RPA 6-spindle fully automatic Chucking Machine with carbide tipped tools at a net output rate *more than 6 times faster* than was possible on the turret lathe method formerly used.

Performances like this have demonstrated to the owners of more than 45,000 Acme-Gridley bar and chucking automatics that design rigidity and tooling ingenuity are your best insurance for sound production and profitable end results.

Acme-Gridley Chucking Automatics are built in 4, 6 and 8-spindle models with capacities ranging from 5¼ to 12".

★ **Ask for guaranteed figures on your work—Tough jobs or otherwise.**

JOB FACTS:

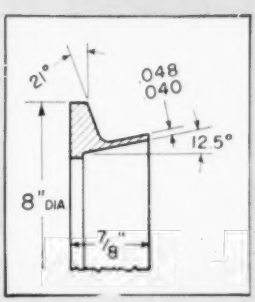
PART—Jet Combustion Chamber

SIZE—8" Diam., ⅞" long

MATERIAL—Type 321 Stainless Steel

OPERATIONS—13, all with Carbide Tools

MACHINE TIME—1 minute, 16 seconds



The NATIONAL ACME COMPANY

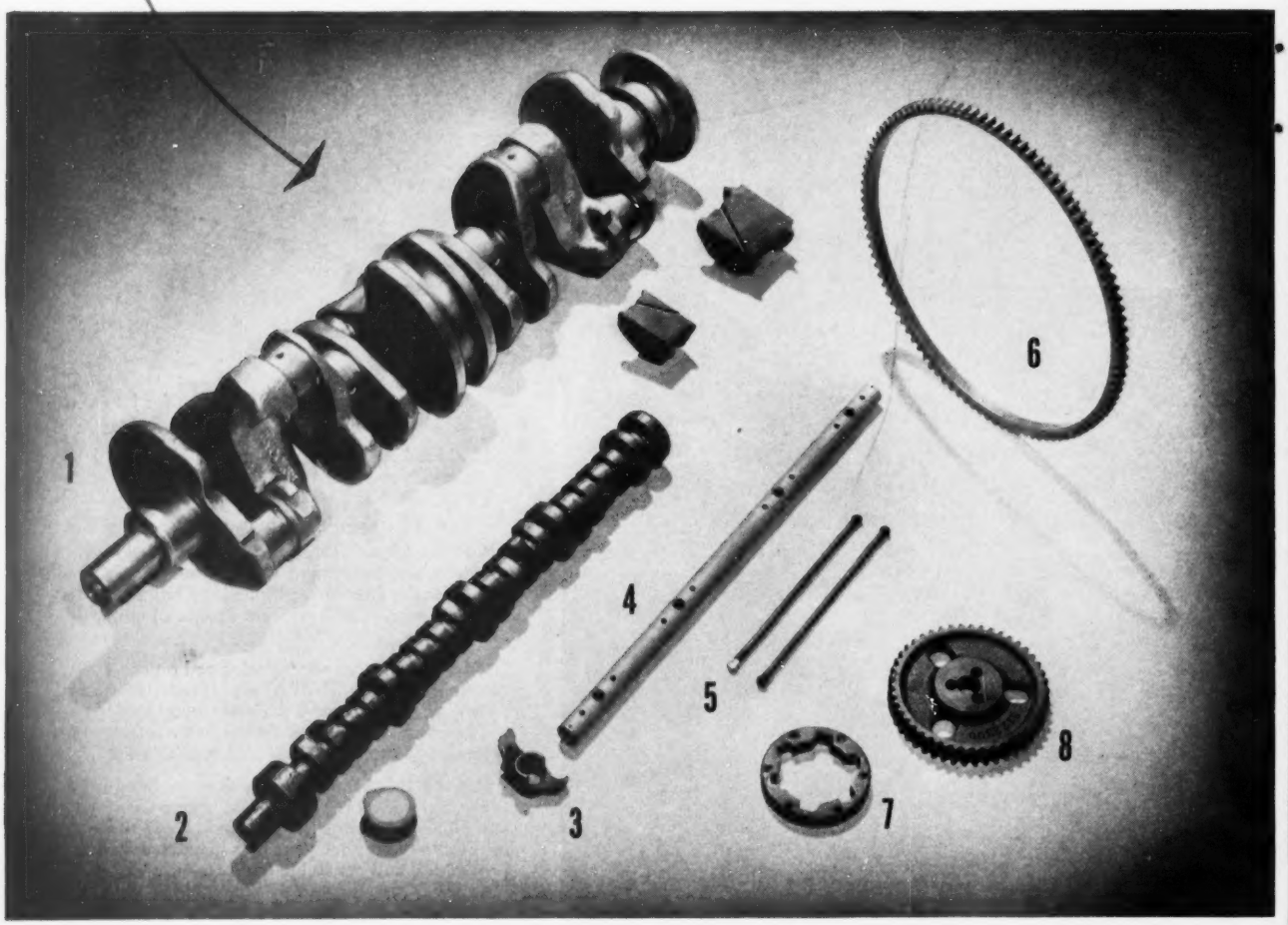
170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics, 4, 6 and 8 Spindle —Hydraulic Thread Rolling Machines—Automatic Threading Dies and Taps—Limit, Motor Starter and Control Station Switches—Solenoids—Contract Manufacturing.

what we hardened and how we did it

1. Crankshaft
2. Camshaft
3. Rocker arm
4. Rocker arm shaft
5. Push rod
6. Starter ring gear
7. Overriding clutch cam
8. Timing gear

Here's a quick "road show" of Flamatic selective surface hardening applications to automotive parts, demonstrating the wide range of shapes and sizes Flamatic can handle on a high production basis. Operation photos show how flexible tooling makes the basic Flamatic machine extremely productive.



These applications illustrate the three basic Flamatic principles—concentrate heat, control temperature, and confine hardness—which result in exceptional uniformity of results.

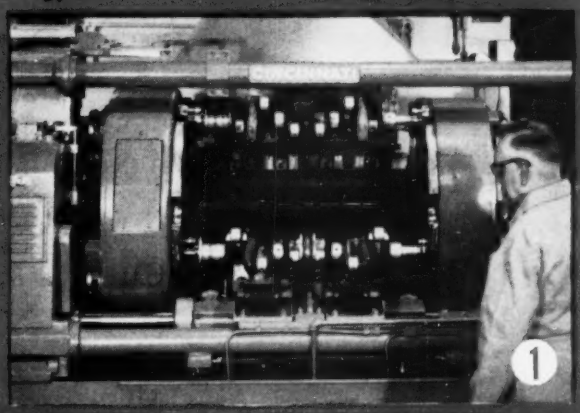
While the machines illustrated involve special modifications or tooling for long runs at high production, standard Flamatics permit economical handling of short runs when parts can be handled with relatively simple tooling or work-holding fixtures.

The Cincinnati Flamatic Heat Engineering Laboratory is at your service to analyze your needs, test-run your parts, and make recommendations. Write for Publication No. M-1724.

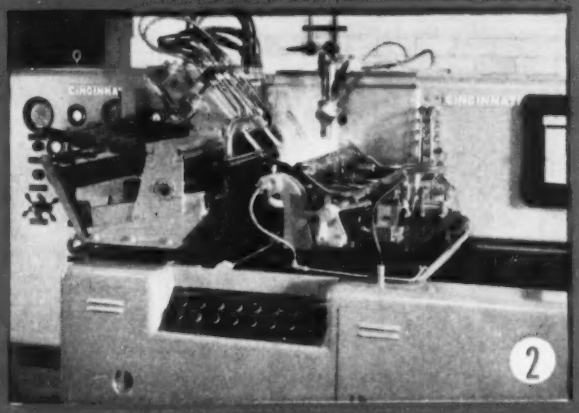
flamatic

THE CINCINNATI MILLING MACHINE CO.

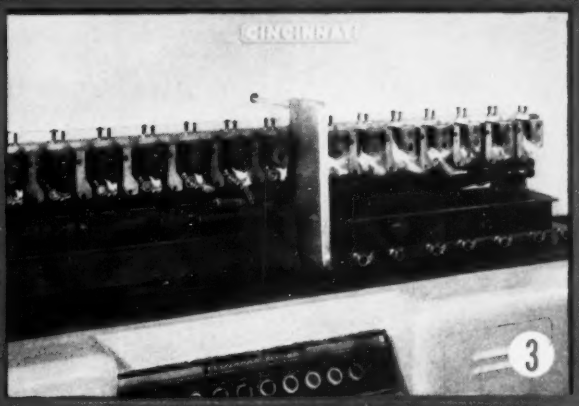
Cincinnati 9, Ohio, U.S.A. • CINCINNATI



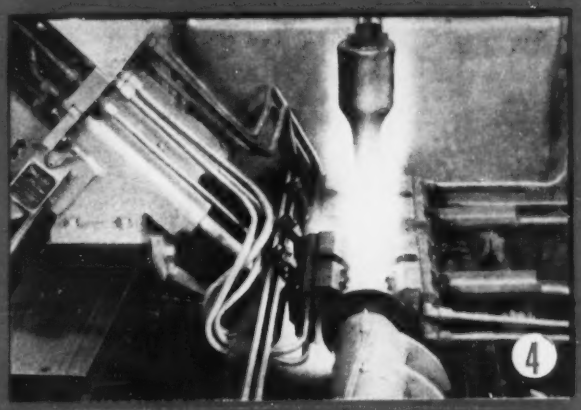
Flomatic selectively hardens all throw and main bearings of crankshafts.



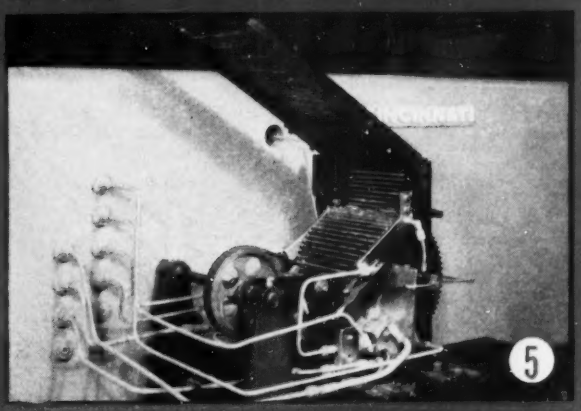
Selective hardening commences. Operation fully automatic except for loading.



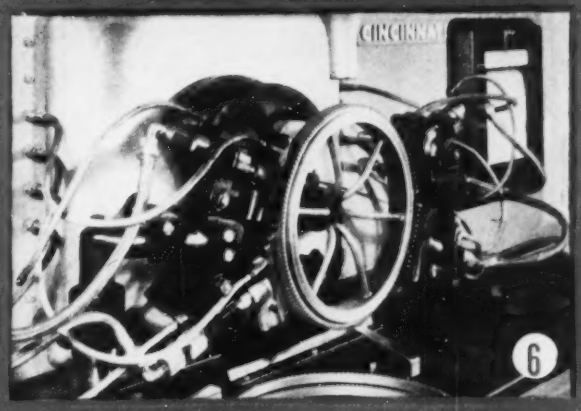
Two-station Flomatic selectively hardens cups and pads on seven rocker arms simultaneously while operator loads other station.



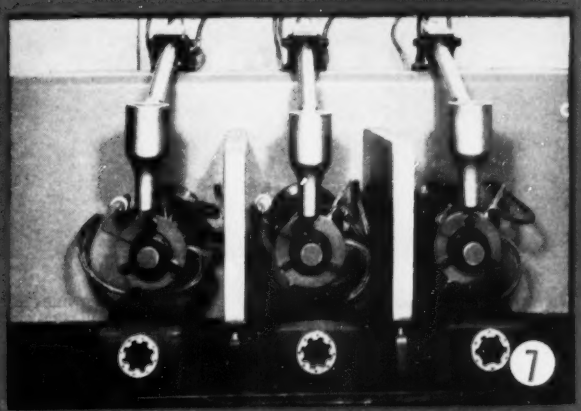
Selective hardening eight bearing surfaces on rocker arm shaft.



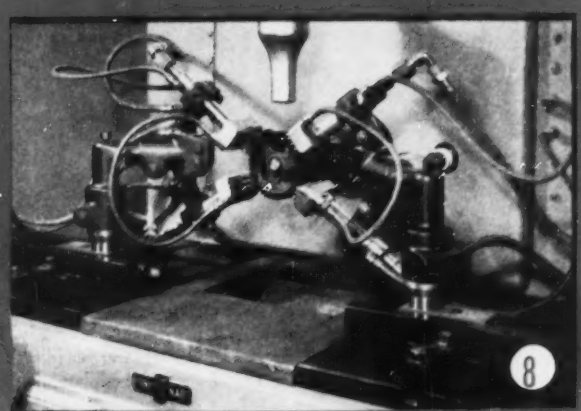
Sliding type flame heads permit continuous selective hardening of push rods.



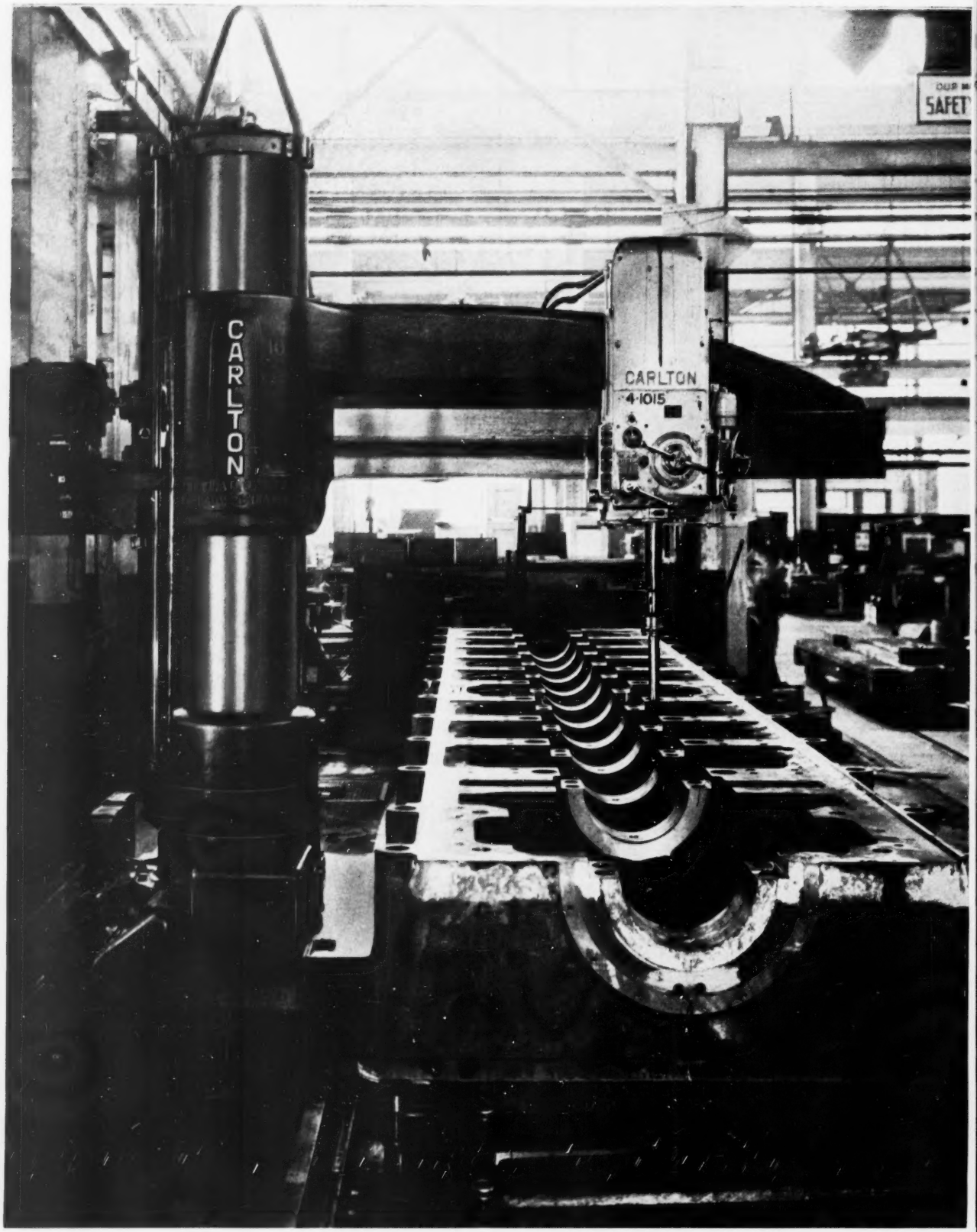
Two-at-a-time Flomatic hardening of ring gears provides 300/hr. production.



Three machines in one: Permits simultaneous selective hardening three sizes of overriding clutch cams for automatic transmissions.



Four flame heads harden two timing gears simultaneously.



MOBILITY WITH ACCURACY: This husky Carlton 5-A radial drill, with track-type base, quickly and accurately drills and bores bulky jobs that extend over large areas like this 9-cylinder 3600-hp Nordberg diesel engine bedplate. This arrangement offers peak efficiency since one machine can handle the entire job. The track type base is very popular with Carlton customers. Carlton radial drills are also available with a variety of other bases . . . there's one for your requirements!

LOW HUNG DRIVE. Spindle accuracy and rigidity are assured because the spindle is always close to the radial arm support. This design eliminates spindle twist, which is one cause of vibration, thus reducing manufacturing costs by increasing tool life.

PUSHBUTTON CONTROL. You can use both hands when you run a Carlton. That's the natural, efficient, profitable way . . . with controls arranged in logical, convenient order on both sides of the head. Two levers control 36 spindle speeds.

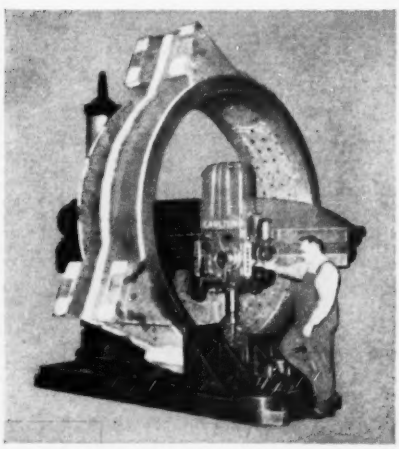
POWER CLAMPING. Head, column an arm clamped with electro-hydraulic powe Column clamp (above) gives 20% mor rigidity than previous designs, assures bette finish. Column and head coupled together s that one pushbutton operates both units.

Radial Drill Users Demand Operating Ease and Efficiency

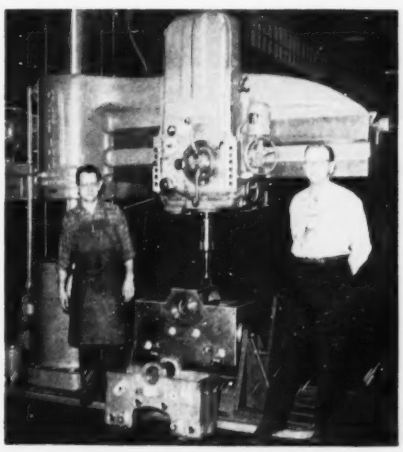
Radial drills have gone through considerable evolution during the last 25 years. As a result, the modern radial drill is a sleek, versatile machine tool, perfectly exemplified by the Carltons shown on this and the opposite page.

Carlton has won the approval of radial drill buyers because of outstanding operating ease and efficiency. This combination pays off in more hole production, low operating and maintenance costs, less operator fatigue.

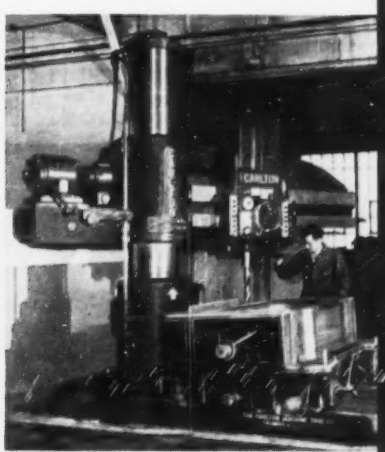
A glance at the accompanying photos will show you a fe of Carlton's exclusive design features . . . and will give yo some idea of the broad range of work of which they ar capable. They're setting performance records in plants a over the world. You can get the 'hole' story by writing u today for descriptive literature. The Carlton Machine Too Co., Cincinnati 25, Ohio, U.S.A. Only *One* Can Be Calle 'the finest'.



BIG DRILLING JOBS like this one at Newport News Shipbuilding and Dry Dock Co. call for Carlton radial drills. In spite of the gigantic size of the casting, this Carlton 4-A drilled it quickly, efficiently and accurately.



REVOLVING FIXTURES make Carlton radial drills doubly productive. This set-up —at Rodgers Hydraulic Incorporated, Minneapolis—increased hole drilling production from one casting a day to five.



CARLTON 4-A RADIAL drills holes a locates pins in bathtub molding machine f American Radiator & Standard Sanita Corp., Richmond, Calif. Job requires clo precision . . . and gets it from Carlton.

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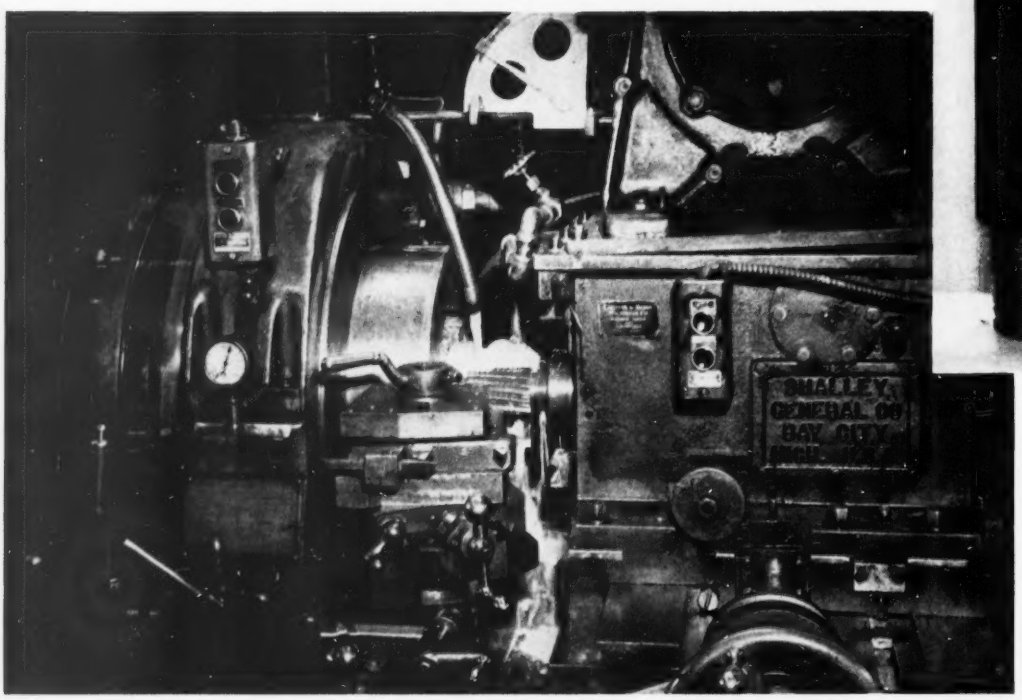

ONE of the important steps in making the Hydril Company's patented Twinpin Connectors is the milling of a step thread. The job is done on Smalley General Thread Millers, using a 1:20 emulsion of *Texaco Soluble Oil C.*

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By LORING F. OVERMAN

More Machine Tool Orders for Defense Requirements

RECENT announcement that Russia seems to have both the A-bomb and the H-bomb has resulted in another revision of the defense picture, with a marked upgrading of requirements. For one thing, there will be fewer personnel cuts than would have been possible under more peaceful conditions. The production program will continue and a new round of machinery and machine tool purchases will keep pace with changing designs in aircraft, guided missiles, and atomic weapons.

Machine Tool Leasing Policy

A new machine tool leasing policy is being worked out jointly by the Department of Defense, Defense Mobilizer Arthur S. Flemming, and Commerce Secretary Sinclair Weeks. The policy is to provide a uniform set of standards for determining which concerns are to be eligible to lease tools from the stockpile of production equipment maintained by the Air Force, Navy, and Army. One object is to make certain that machine tools may be leased only by defense producers and by defense-supporting industries. The directive contains a definition of "defense-supporting" to permit consistent administration of the new policy.

ALSO written into the directive is a virtual ban on breaking up a "machine tool production package" merely to provide one or more tools needed by some defense production plant. The term "package" is understood to mean a complete production line of tools—taken out of a mothballed factory and held in readiness for use in an emergency. Defense planners have expressed the feeling that the entire effectiveness of the machine tool stockpiling program could be defeated if such "packages" were broken into and the sequence of a production line interrupted. To put a stop to such raids, the policy directive is to require that a break be first approved by the Deputy Secretary of Defense, the Defense Mobilizer, and the Secretary of Commerce jointly.

December 31 is the new date set for completion of the Armed Services machine tool inventory. It had been planned to have the inventory complete by October 15, but some compilations proved difficult. By the end of the year, the Navy inventory report is expected to be substantially complete; the Air Force 90 per cent complete; and the Army Ordnance somewhat less than 90 per cent. Supply officials are pushing for completion of the inventory, believing it to be the first step toward getting a defense production machine into operation in the shortest possible time in the event of an emergency.

Push-Button Factories

Washington is still hoping that, in the event of another war, the United States will have developed "push-button" warfare to the highest degree. The progress made in guided-missile production and flight provides food for thought. Among other things, it leaves the impression that if an enemy were to launch an attack on us with similar missiles, some push-button method would have to be depended upon for locating and destroying the enemy's weapons while still in flight.

The Department of Defense is eyeing new push-button machine lines to speed production, reduce the number of man-hours required to build major equipment, and control as much as possible the factor of human error. Recalling the Detroit influence on the Department of Defense, it is quite likely that new defense production will be redesigned to permit as much push-button operation as possible.

Korean Breather

The truce in Korea, halting the destruction of aircraft, provides an uneasy breathing spell during which the Department of Defense is retooling to get into production on new types of airplanes such as the F-100 Super Sabres and the B-52 long-range bombers. Involved are advanced types of airframes, parts of which may come from some of the recently built heavy presses, together with new and improved jet engines. DOD hopes to be able to get into full production of the improved planes before any emergency arises. Officials are greatly concerned, however, over reports that the Korean truce is being violated by the build-up of numerous bases in North Korea, equipped with what radar-carrying camera planes identify as "literally hundreds" of jet fighters and bombers.

IN addition to the physical details of defense production, Washington is still working on a set of controls which would provide for a quick transition from peace to a war economy, if necessary. Defense Mobilizer Flemming expects to have a modified Controlled Materials Plan ready to announce by January 1. The principal purpose of the stand-by controls outline would be to modify procedures of gathering information about requirements and of passing out allotments.

Budgets and Taxes

Probably the most embarrassing problem of the Administration is the difficulty in making good on its promise to balance the budget and pare taxes. Currently, concern over the H-bomb development points to the probable need for higher defense expenditures rather than lower. Although the present plan of the Treasury Department is to let the excess profits and individual income tax reductions go into effect on schedule, tax planners are worried over where to round up additional revenue. Such a frame of mind could result in new types of excise taxes. Business will want to keep in touch with Washington lest surprise levies be announced.

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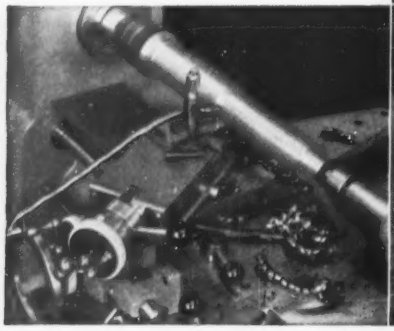

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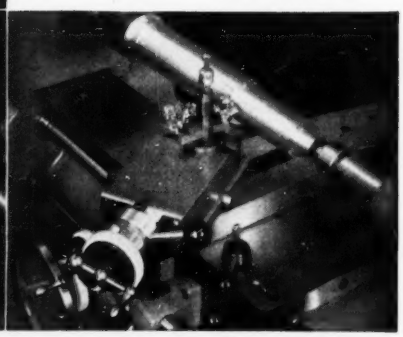

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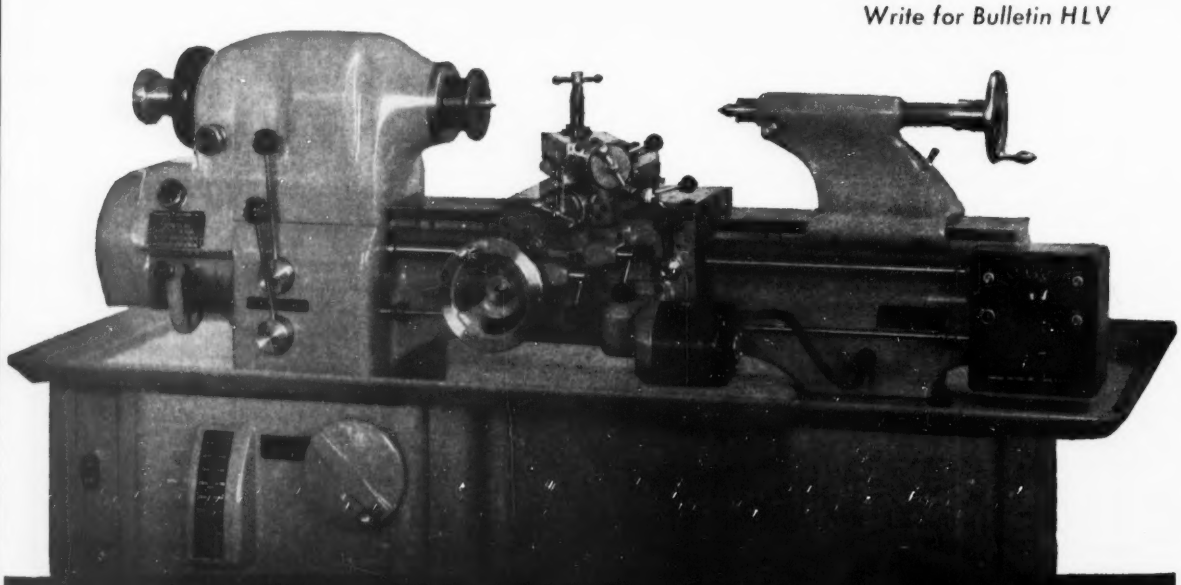

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MACHINERY
NOVEMBER 1953

Behind the Mechanical Magic of the Automobile

THE automobile industry expects to produce six million cars this year and approximately the same number in 1954. Prospective buyers apparently want to keep up-to-date so far as their personal means of transportation are concerned. They want cars with the latest mechanical improvements and body designs.

In this fact lies one of the secrets of the phenomenal progress of the automotive industry. From a humble beginning in which automobiles were merely buggies propelled by small gasoline engines, designers have consistently intrigued customers with features which by their very nature make previous models quickly obsolete. Pneumatic tires, self-starters, sliding gear transmissions, four-wheel brakes, hydraulic shock absorbers, automatic transmissions, and power steering mechanisms are representative of outstanding developments that boosted automobile sales.

Few automobile owners comprehend the vast amount of research involved in perfecting unique mechanical devices, as well as the thought that must be given to processes and machinery necessary for the manufacture of a new device on a practical and economical basis. After the product designers come the men who determine the best manufacturing methods and develop the most suitable machinery and tools.

Frequently, new processes must be developed or existing methods adopted that have not previously been employed by the automotive industry. To such developments the editorial section of this number of MACHINERY is primarily devoted. Shell-mold casting, for example, is now being used in producing components for power steering units and automatic transmissions, one of the first applications of this process in the automotive industry. The subject is covered in a feature article. Another deals with the use of plaster cores in casting torque converter parts for automatic transmissions.

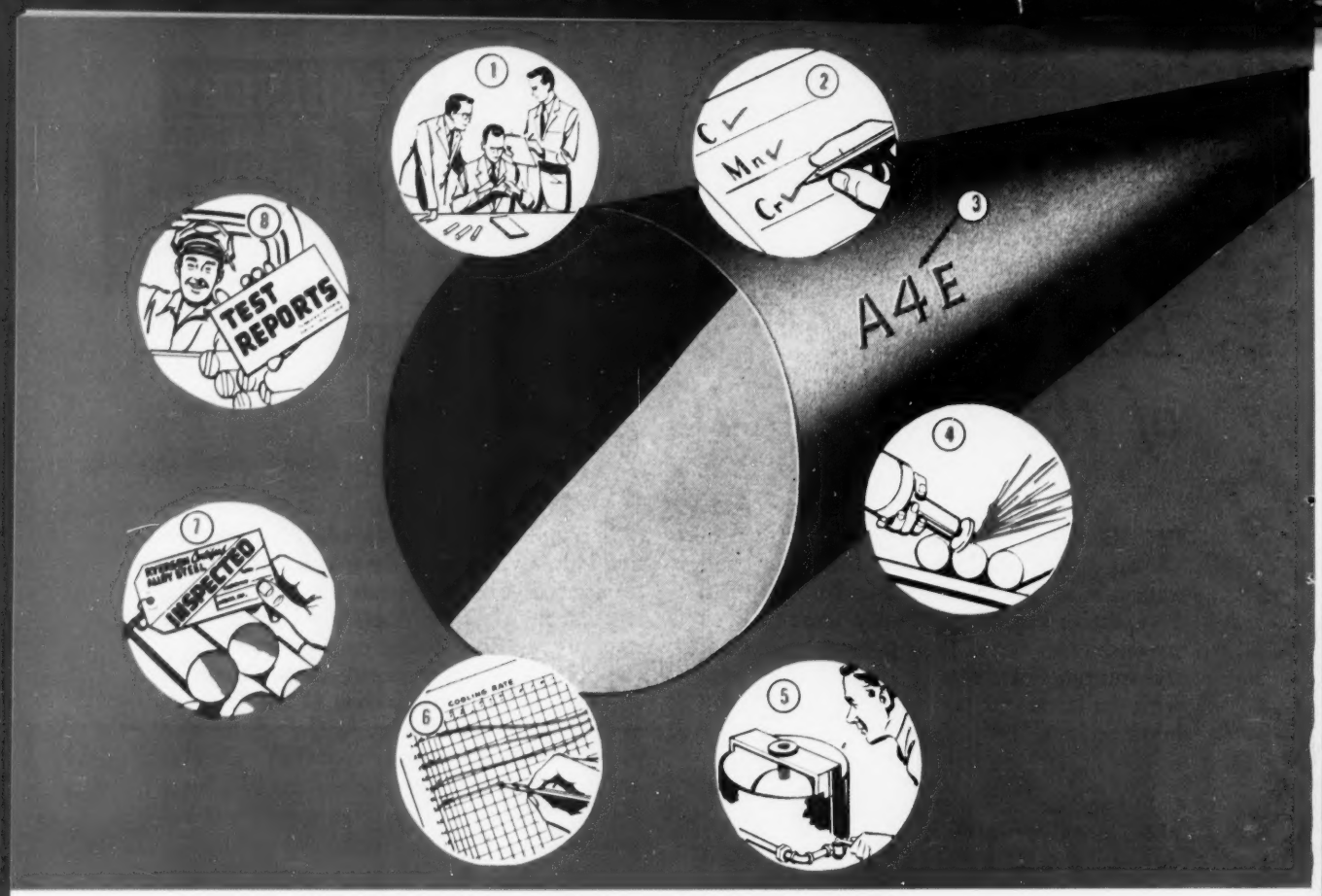
Plastic dies have been employed for several years in airplane manufacturing plants and their use has now spread to the automotive industry, which has found this type of tooling especially convenient in making experimental and prototype stampings. Dies for an automobile hood are featured.

Chip disposal is commonly an onerous problem in high-production plants. One enterprising concern recently installed equipment for crushing the steel turnings obtained from machine tools, extracting the oil, and then conveying the chips pneumatically to storage hoppers. This installation is treated in detail. Work-handling between operations is covered in an article on automation.

All this is evidence that the production men of the automotive industry continue to have a progressive outlook in seeking and applying new methods for the solution of their manufacturing problems.

Charles O. Herb

EDITOR



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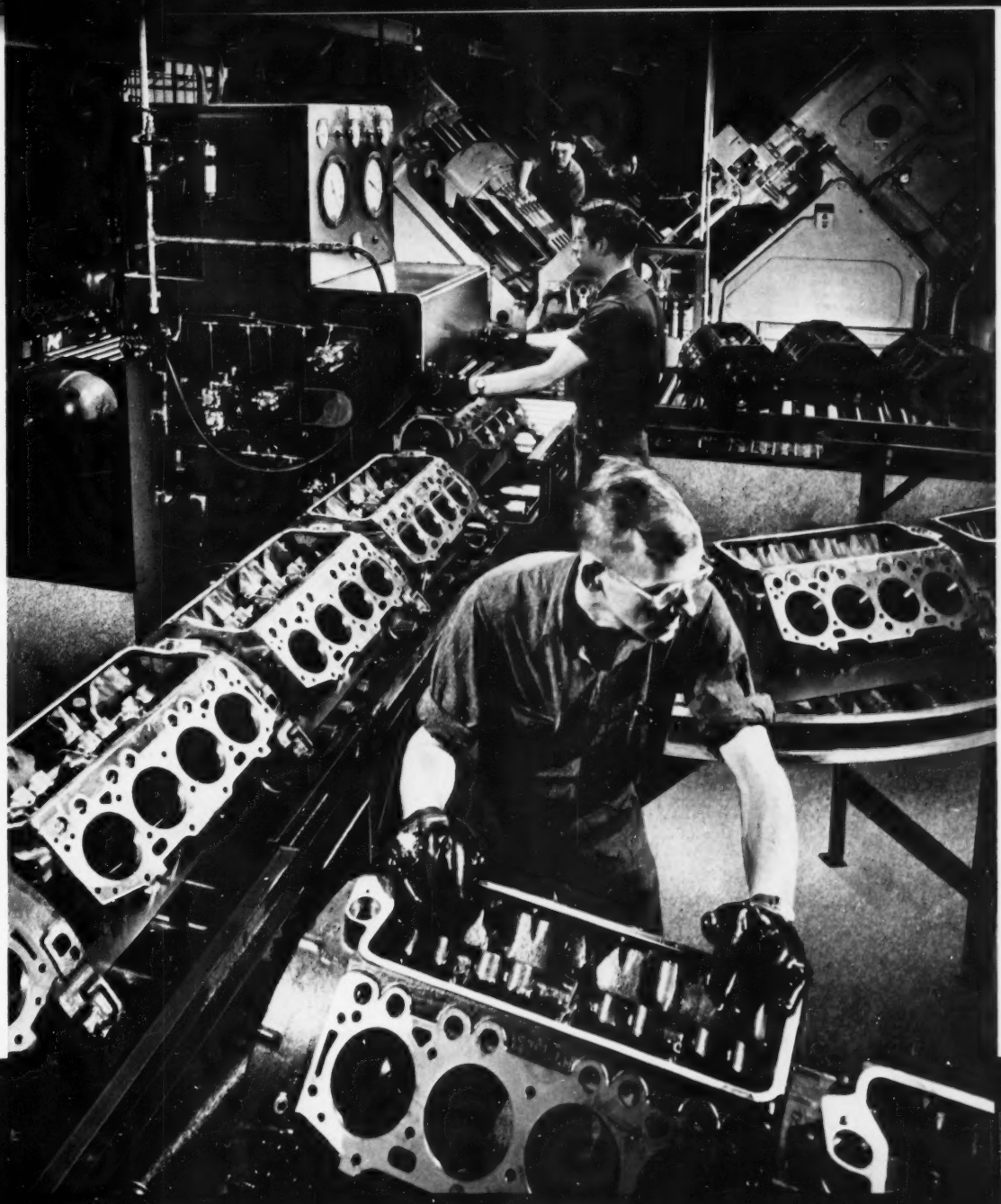


The Automotive Industry Prepares for a Buyers' Market

In traditional manner, the automotive industry has prepared for the competitive period ahead by the development of highly productive processes that insure quality at lowest manufacturing costs. Outstanding developments of well-known automotive concerns which will meet the changed manufacturing conditions are featured in this number.

Vol. 60, No. 3 MACHINERY November, 1953

Producing Chevrolet's High-Compression "Blue Flame" Engine

Adaptation of existing equipment, ingenious tooling, and the acquisition of some special machinery made it possible for Chevrolet to produce a greatly improved engine

By A. R. COLE, General Superintendent of Production
and A. L. LESTER, Master Mechanic
Chevrolet-Tonawanda Division
General Motors Corporation
Tonawanda, N. Y.

WHEN plans for the 1953 Chevrolet were being made, the possibility of introducing a major change in engine design appeared remote because of the long deliveries being quoted for special production machinery. However, by exercising considerable ingenuity in the adaptation of existing equipment, the design of unique tooling and unusual set-ups, and the acquisition of only a limited quantity of special machinery, it became possible to mass-produce a greatly improved engine.

Engines powering this year's Chevrolets retain the basic six-cylinder, valve-in-head principle that has been characteristic for almost a quarter of a century. Important improvements have, however, been made by increasing the diameter and lengthening the stroke of the pistons, thus increasing displacement and compression. The "Blue Flame" engine for powering Chevrolet automobiles equipped with Powerglide automatic transmissions has a compression ratio of 7.5 to 1 and develops 115 H.P.

A major improvement in the high-compression engine—one which required extensive alterations in the manufacturing processes—was the change-over to die-cast aluminum-alloy pistons. These lighter pistons, having cam-ground skirts and steel struts to control expansion, eliminate the need for piston-pin bushings.

Because special machinery could not be delivered in time to meet the required production date, it was necessary to design and process the pistons without their having centers. Pistons without centers are more difficult to machine, and the maintenance of close dimensional tolerances is troublesome. These problems were eliminated by performing practically all of the machining with one setting of the work-piece on Baird six-spindle, automatic chucking machines such as the one shown in Fig. 1. This is the first machining operation performed on the cast-aluminum pistons with the exception of rough-turning and facing performed at the foundry.

Pistons are loaded in magazines and are fed by gravity to the automatic chucking machines. Here the castings are picked up automatically, as seen in Fig. 2, by a mechanically operated, expanding type work-locating and gripping fixture. Thickness of the piston dome is accurately controlled by locating from die-cast inner surfaces on the piston.

When the piston has been indexed counterclockwise to the second station, its ring grooves are rough-formed, a 0.060-inch wide expansion slot is cut, and the piston skirt is faced to length by means of five carbide tools pre-set in a toolblock mounted on the cross-slide, as shown in Fig. 3. The two compression ring grooves are rough-formed to a diameter of 3.145 inches by 0.0625 inch wide, while the one oil-ring groove is cut to the same diameter but 0.155 inch wide. Rough-turning of the piston skirt and ring lands is performed with two carbide tools on the longitudinal slide at the third station, and the piston dome is rough-faced by a round, carbide tool on the hexagonal bar at the same station. These same surfaces are finish turned and faced with three similar tools, and all of the ring lands, the dome, and the skirt are chamfered by means of six tools on the cross-slide at the fourth station.

The two compression ring grooves are finish-machined to a diameter of 3.160 inches and width of 0.0960 inch, and the oil-ring groove to the same diameter and a width of 0.1885 inch, by three tools mounted on the cross-slide at the fifth station. The completely turned pistons are automatically ejected from the machine when they have been indexed to the sixth station, as seen in Fig. 4.

The pistons are rotated at 1429 R.P.M., pro-

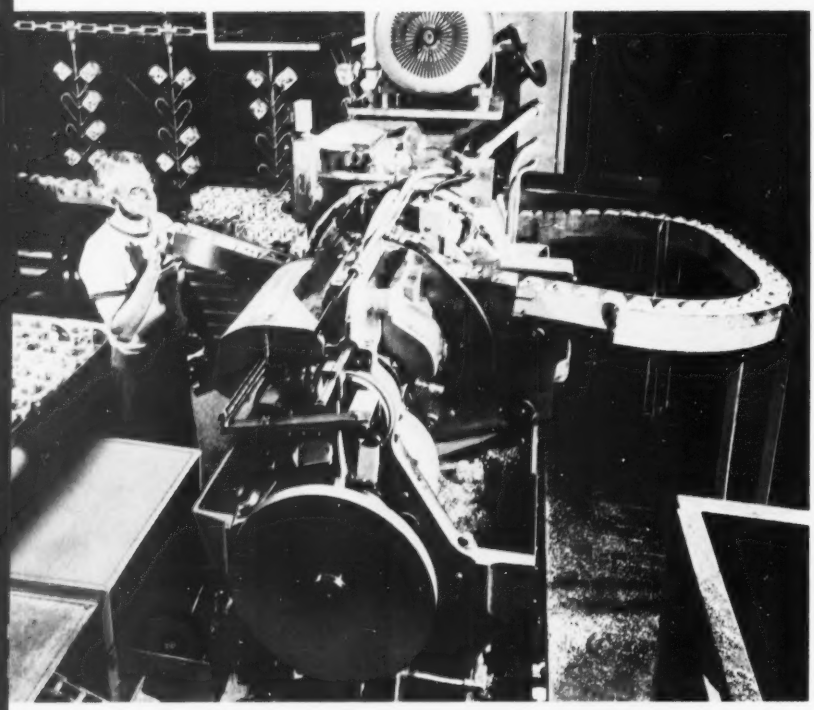


Fig. 1. Practically all of the machining operations required on the cast-aluminum pistons are completed with one setting of the work on this six-spindle automatic chucking machine.

viding a cutting speed of from 1332 to 1350 feet per minute. Grooving tools mounted on the cross-slides of the automatic chucking machines are fed 0.0025 inch per revolution, and facing tools 0.018 inch per revolution. The turning tools on the longitudinal slide are fed 0.025 inch per revolution.

Each six-spindle automatic chucking machine is capable of completing 340 pistons per hour. Actual cutting time at each machining station is only 4.7 seconds, and floor-to-floor time per piston is 7.36 seconds. Previous methods of finish-turning cast-iron pistons required four separate operations. Now the same results are being obtained in one operation at a faster production rate and with less chance of error.

After rough-boring the wrist-pin holes and drilling the small angular oil-holes, it is necessary to mill the pistons to weight. The aluminum pistons used in engines for Powerglide transmission applications must all weigh the same within plus or minus 2 grams. Toledo

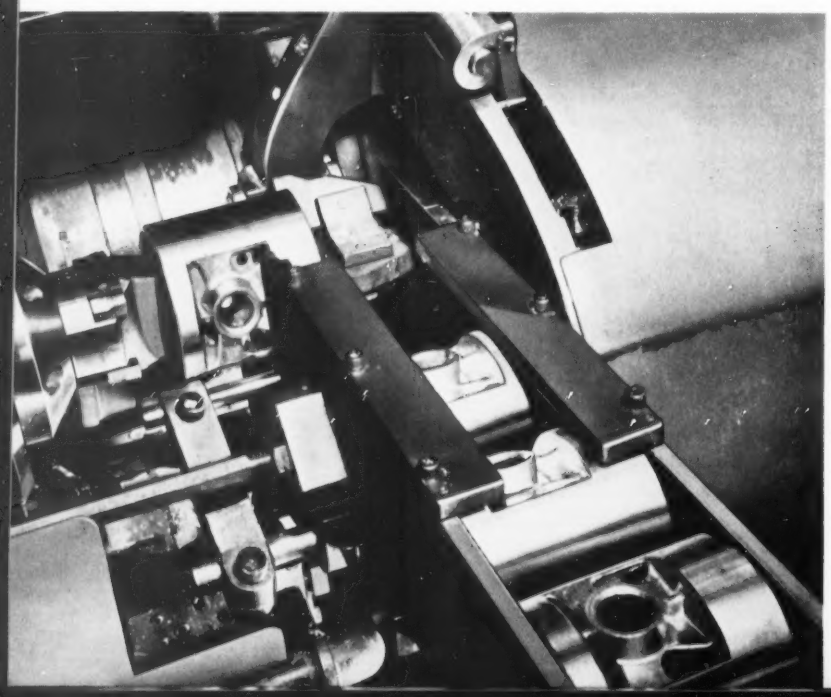


Fig. 2. Close-up view of the machine illustrated in Fig. 1, showing how the cast pistons are picked up automatically by a mechanically operated expanding fixture.

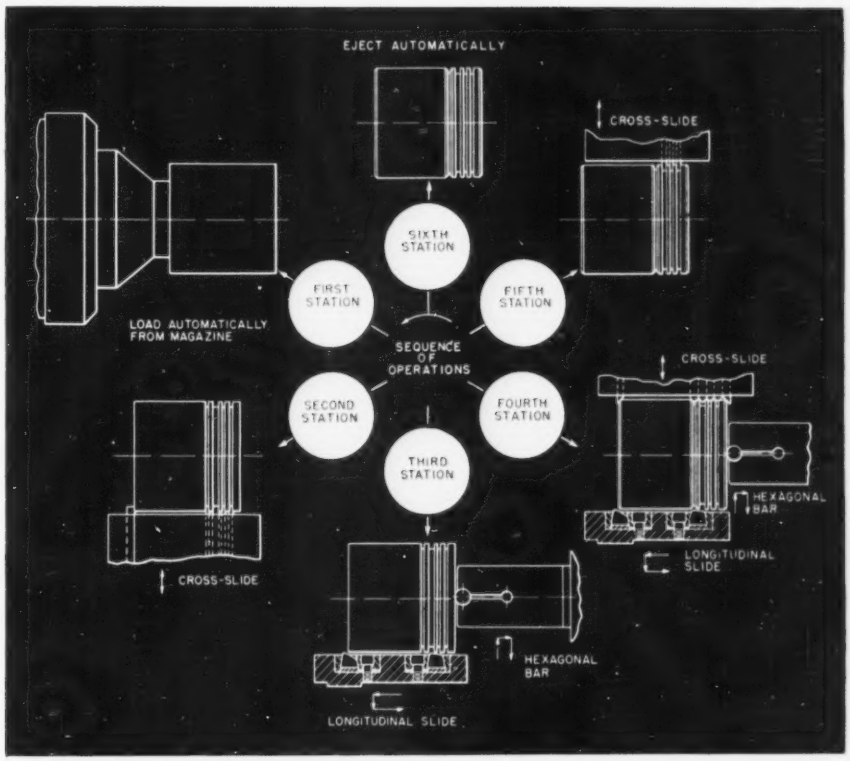


Fig. 3. Layout of the tools employed at various stations of six-spindle automatic chucking machine Carbide tools are pre-set in tool-blocks.

semi-automatic, dynamic classifiers are used to weigh the pistons.

The pistons are first weighed to determine the amount of metal to be removed, if any, to bring them within the weight specifications. Each piston is placed on the scale platen and a push-button is depressed. The classifier is of the electronic type, and indicates the weight by means of two rows of lights, one row representing the number of grams and the other the tenths of grams that the piston weighs. Since the classifier is pre-set with a known weight, the lights are interpreted with respect to the known weight. When the piston is removed from the scale, the lights will remain on until the scale is cleared.

Dials at each station on a Davis & Thompson Roto-Matic milling machine are set to remove

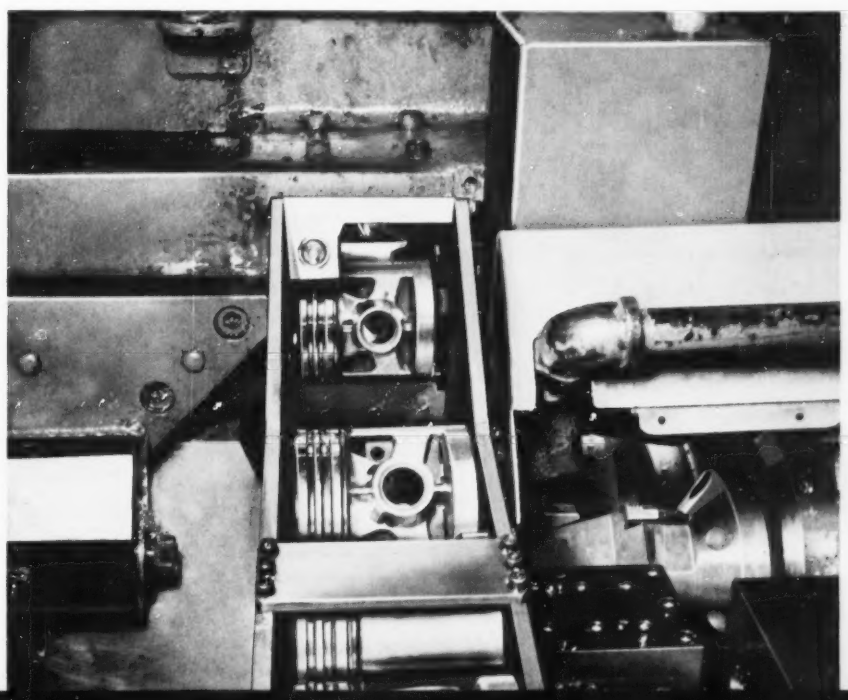


Fig. 4. Turned pistons are automatically ejected from the machine when they have been indexed to sixth station.

Fig. 5. Air gages used to classify pistons according to their outside diameter, and inspect wrist-pin holes for pin assembly.

the required amount of metal in accordance with indications of the lights on the classifier, and the pistons are placed in the corresponding fixtures on the rotary table of the machine. The pistons are weighed again to insure that they meet the specifications.

After centerless grinding, tin-plating, and diamond boring of the wrist-pin holes, the pistons are conveyed to a room that is maintained at a temperature of 70 degrees F. This room, 44 feet long and 30 feet wide, constructed of insulated sections and equipped with two 15-ton capacity Frigidaire cooling units, insures precision fitting of the aluminum pistons and steel wrist-pins with the cast-iron cylinder blocks of the engine.

Wrist-pins are stored for twenty-four hours in the constant-temperature room before being classified on special automatic machines that separate them into ten groups, each group varying from the next by only 0.0005 inch. To insure that the pistons are the desired temperature (70 degrees F.) before being classified, they are washed in a cold solvent washer and carried through a refrigerated air cooling chamber before entering the constant temperature room. Inside the room, the wrist-pin holes are "Bearingized" and the pistons are placed on an over-

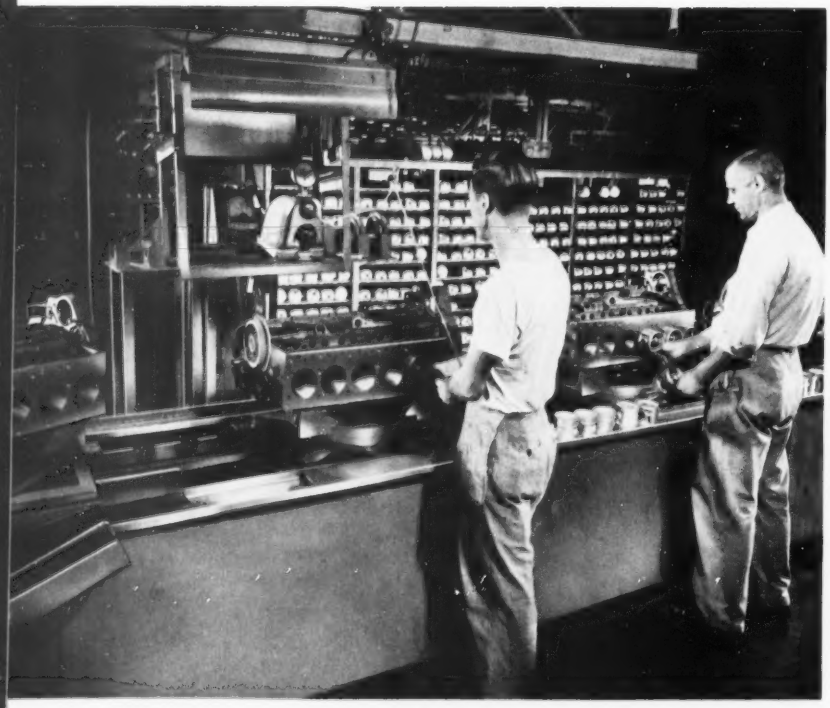


Fig. 6. Classified piston and pin assemblies are placed in racks (as seen in background), bores in cylinder blocks are inspected, and required size pistons are assembled.

head zigzag conveyor that allows them to cool for approximately one hour.

When the pistons are removed from the overhead conveyor, they are inspected 100 per cent by means of Sheffield Precisionaire gages such as those shown in Fig. 5. The dome of each piston is marked with one of ten outside diameter classifications, each classification varying by only 0.0002 inch. When the wrist-pin hole has been gaged, the operator selects a pin of the indicated classification and hand-fits it to the piston. The piston and pin assemblies are placed in the correct channel (depending on the markings on their domes) on another conveyor that carries them out of the constant-temperature room.

Piston and pin assemblies are then placed in racks (marked according to the classifications) alongside the main assembly line, as seen in the background of Fig. 6. Here, the bores in the cylinder blocks are inspected with Pratt & Whitney Air-O-Limit gages, and the corresponding size pistons are selected from the racks and assembled.

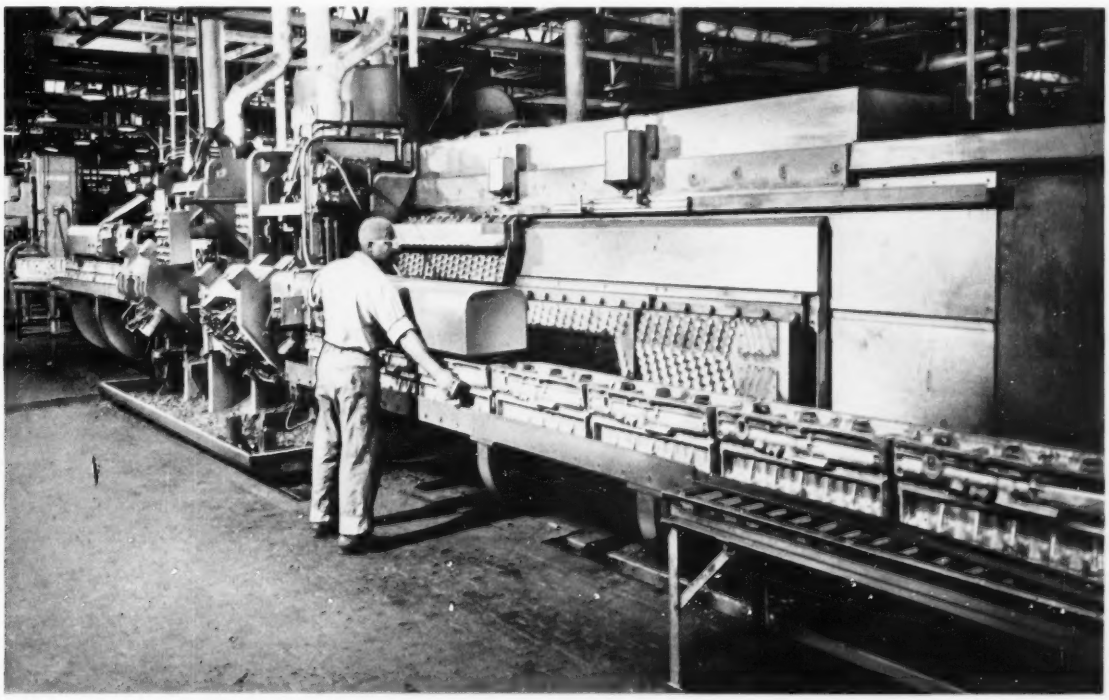
Main bearing surfaces, the pan-rail face, the cylinder head contact surface, the push-rod cover rail, and the ignition distributor boss on the cast-iron cylinder blocks are all machined on the huge Cincinnati two-way, horizontal broaching machine shown in Fig. 7. This machine is provided with a rack-and-pinion planer type drive, operated by a variable-speed motor which permits broaching at speeds of 100 feet per minute or more.

An automatic, dog type transfer bar moves a rough casting from a conveyor into the first station fixture of the broaching machine. The cylinder block is located and clamped in the fixture hydraulically. When the cycle button is depressed, this fixture rotates 90 degrees into a vertical position and the machine ram moves to the right to broach the pan-rail face and four main bearing surfaces.

When the ram reaches the end of its stroke in this direction, the fixture is swung back to the horizontal position and the cylinder block is automatically transferred into a roll-over fixture which rotates it 180 degrees. Then the casting is transferred into the second station fixture, located, clamped, and swung into a vertical position. When the ram returns to the left, the cylinder head contact surface, push-rod cover rail, and ignition distributor boss are broached. Completely broached cylinder blocks are automatically swung back to the horizontal position and unloaded.

The ram on this broaching machine is equipped with a total of approximately 1100 inserted tungsten-carbide-tipped tools for roughing and inserted solid-carbide blades for finishing. The

Fig. 7. Two-way, horizontal machine for broaching bearing surfaces, rails, mating faces, and bosses on cast-iron cylinder blocks.



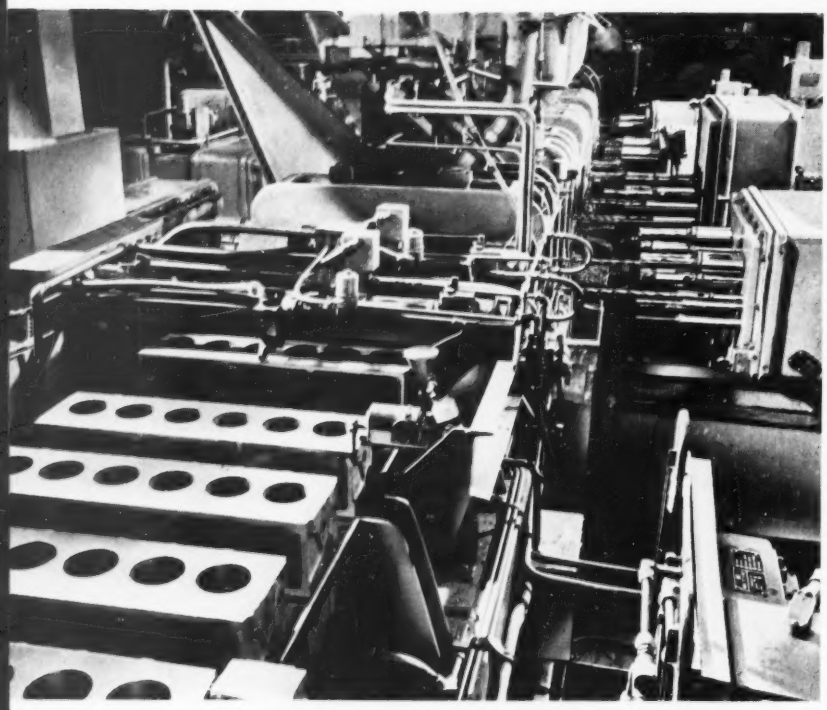


Fig. 8. Air-operated fixture at unloading end of eight-station transfer machine pressure tests gallery hole in cylinder block.

tools are divided into upper and lower sets, the upper set cutting as the ram moves to the right, and the lower set as the ram returns to the left. About 3/16 inch of stock is broached from the various surfaces.

All holes in both the front and rear ends of the cylinder block are drilled, reamed, bored, counterbored, tapped, or chamfered on a Natco eight-station, two-way transfer machine equipped with 100 spindles. An air-operated fixture (Fig. 8) for pressure testing the oil gallery hole drilled in the cylinder block has been provided at the unloading station of this transfer machine.

This air test fixture, which was designed and built by Chevrolet, operates automatically while the transfer machine is working. As each casting is transferred out of the machine and into the fixture, the chips are blown out of the oil gallery hole to be checked. Then, an air cylinder automatically clamps a rubber plug into each end of the hole. Compressed air is introduced through one plug and, if a leak is indicated by a drop in the air pressure, an automatic spray gun paints the front end of that casting yellow. Painted castings are either repaired or scrapped.

Final washing of the cylinder block assemblies is performed on the multiple-station washer seen in Fig. 9, which was designed and built by the plant engineering department at Chevrolet-Tonawanda. This washer consists of two main units—an in-line indexing type washing and blow-off unit; and an eight-station, rotary indexing machine.

In the first unit, the castings are hydraulically indexed through a flushing type washer equipped with high-volume, low-head pumps. Water, heated to 180 degrees F. by direct steam injection, is pumped through a drum type rotary screen equipped with an automatic backwash system to insure that the parts are washed by a continuous flow of clean, hot water. After being indexed through the washer, the blocks are automatically located and clamped in a fixture, and air nozzles are inserted in all tapped holes to blow out chips.

Cylinder blocks are then automatically transferred to the second washer—the rotary indexing machine. With a block clamped in each of the eight fixtures, high-pressure (200 pounds per square inch) water is directed through nozzles into all bolt holes and oil passages. When the block is ejected at the eighth station, it is automatically turned over to remove all water, and transferred to the final inspection station.

Forged steel connecting-rod assemblies for the "Blue Flame" engines are milled, drilled, and tapped on the Kingsbury ten-station, rotary indexing machine shown in Fig. 10. The rotary indexing table of the machine is equipped with ten manually operated fixtures, each fixture holding two rods in a vertical position. The rods are located from the wrist-pin holes and sides.

Bosses on the pinch-bolt holes of both rods are straddle-milled at the first station, using cutters 6 1/2 inches in diameter by 1/2 inch wide, operating at a cutting speed of 60 feet per minute

with a chip load of 0.003 inch per tooth. A hole 21 64 inch in diameter by 31 32 inch deep is drilled in each rod in three successive operations performed at the second, third, and fourth stations. These drills are rotated at 40 feet per minute and fed 0.0052 inch per revolution. The holes are counterbored to a diameter of 25 64 inch by 41 64 inch deep at the sixth station, the counterbores also operating at 40 feet per minute and fed 0.012 inch per revolution.

The 1 8-inch wide pinch-bolt slots in both rods are rough-milled at the fifth station. A cutting speed of 55 feet per minute is employed for the 6-inch diameter by 1 8-inch wide slitting saw used to mill these slots. One slot is finish-milled at the seventh station, while the other is finished at the eighth station, using 2 1 2-inch diameter by 0.120-inch thick milling cutters. Chip load per tooth is about 0.003 inch. Finishing saws are made 0.005 inch thinner than those employed for roughing in order to avoid having to match the cuts exactly. The pinch-bolt holes are tapped (3 8-24 threads) at the ninth station, and the connecting-rods are unloaded at the tenth station.

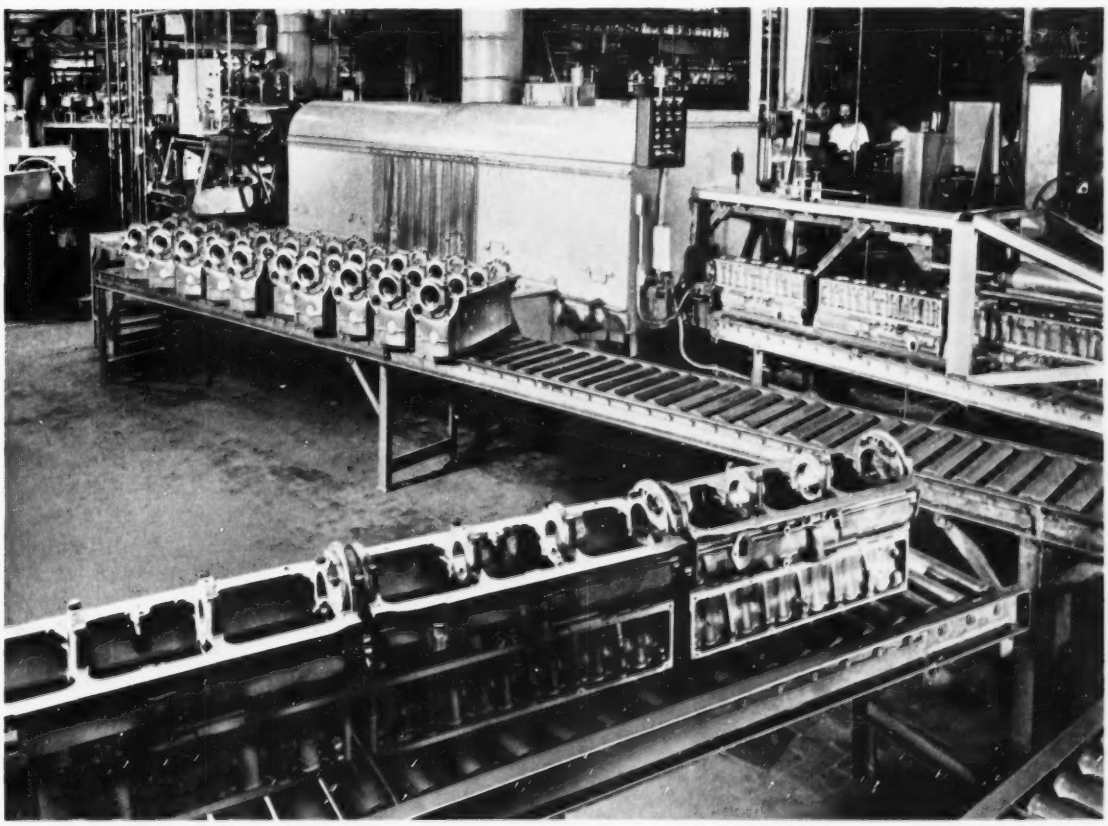
Crankpin holes in the connecting-rod assemblies are finished on Micromatic four-spindle, vertical Hydrohoner machines such as the one seen in Fig. 11. Eight work-holding fixtures are mounted on the hydraulically operated shuttle type table so that four rods can be loaded while four more are being honed.

The length of cycle of each honing spindle is independently controlled by a Microsize unit which continually gages the bore and automatically halts the cycle when the bore reaches the required diameter. Microdial units are also provided to automatically adjust the tool expansion and collapse, compensating for the amount of abrasive used in honing each rod. The honing machine is equipped with a refrigeration unit to control the temperature of the coolant and a magnetic separator to remove abrasive sludge and foreign particles.

From 0.0005 to 0.001 inch of stock is honed from the diameter of each crankpin hole, maintaining size within a total tolerance of 0.0005 inch. Vitrified-bond, aluminum-oxide abrasive of 180 grain size is employed for this operation, the abrasive being embedded in plastic honing sticks.

The speed with which connecting-rods can be

Fig. 9. Cylinder blocks are cleaned on in-line indexing washer and blow-off unit, and on eight-station rotary indexing washer.



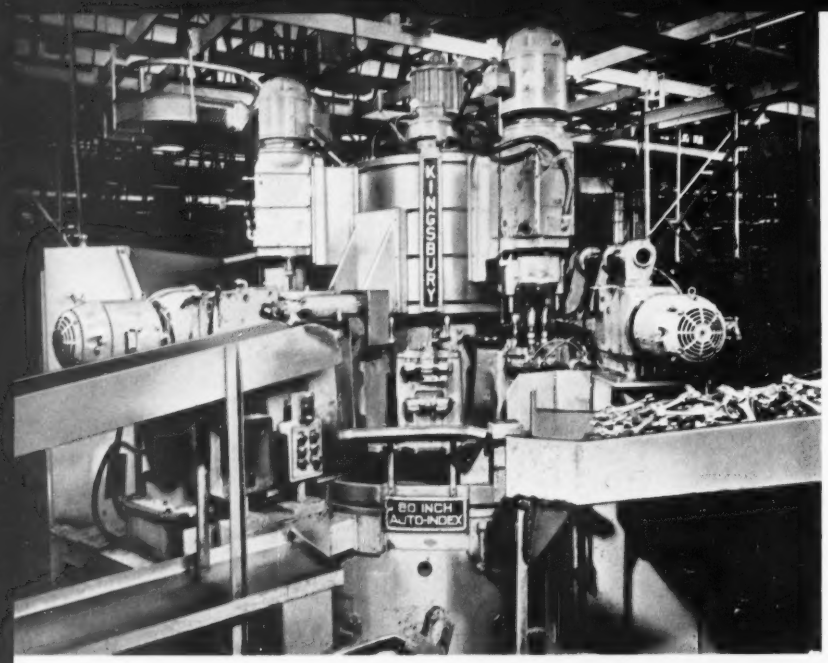


Fig. 10. Ten-station rotary indexing machine for performing milling, drilling, and tapping operations on forged steel connecting-rod assemblies.

Fig. 11. Eight work-holding fixtures on hydraulically operated shuttle table of this machine permits honing four rods while loading another four.

disassembled and stamped has been greatly increased by using the machine seen in Fig. 12, which is made by the Trio Tool Co. Previously, these operations were done with a manually operated nut remover and a hand stamping fixture. Now this machine combines the operations of loosening the nuts on the connecting-rod assemblies, forcing the caps off the bolts, and stamping the mating rods and caps in sets of six.

Connecting-rod assemblies come to the machine (after weighing and sorting) in sets of six. The operator places one assembly in the machine at a time, locating from the crankpin bore and piston-pin hole. When the starting cycle button is depressed, air-operated, spring-loaded stamps on a rotary indexing drum impress the number "1" in the sides of the cap and rod. A slide on which the work-holding fixture is mounted then moves to the left, thus engaging the nuts on the rod with spring-loaded, constantly rotating sockets. When the nuts have been backed off, split pilots in the crankpin bores are actuated to strip the cap loose from the doweled portions of the bolts. With each successive cycle, the drum

on which the stamps are mounted is indexed to the next number—up through six.

All crankpin cheeks on two forged steel crankshafts for these engines are faced simultaneously on Wickes automatic, double-spindle lathes. The crankshafts are driven from both ends by hydraulically operated pot type chucks that clamp on the front and rear main bearings and locate from previously milled spots on the front and rear counterweights. Steadyrests bear on the front and rear intermediate bearings.

Two master crankshafts, enlarged duplicates of the cranks to be machined, control the movement of the six tool-slides (holding twelve high-speed steel cheeking tools) through the cycles of rapid traverse to the starting positions of the cuts, feed movements to the sizing stops, and rapid return to the starting positions. Automatic devices stop the crankshafts in the required positions to permit unloading, thus eliminating the need for the operator to jog the work-pieces.

Average stock removal from each crankpin cheek is 0.080 inch. The crankshafts are driven by a direct-current electrical motor equipped with an automatically controlled rheostat that increases the rotary speed of the cranks from 27 to 80 R.P.M. as the diameters being cut decrease, thus providing a constant cutting speed of approximately 20.6 feet per minute. Feed of the cheeking tools is maintained constant at 0.048 inch per revolution.

Six angular oil lubricating holes, 1/4 inch in diameter by about 5 inches deep, are drilled in the main and crankpin bearings of each crankshaft on a battery of seventeen six-spindle, deep-hole drilling machines, one of which is shown in Fig. 13. The machines, built by the Krueger-Barnes Corporation, Snyder Tool & Engineering Co., Michigan Drill Head Co., and Leland-Gifford Co., are all equipped with Leland-Gifford drilling units having hydraulic step-feed attachments. These attachments automatically withdraw the drills from the holes after drilling 1/4 inch deep to allow the chips to escape. The drills are then advanced another 1/4 inch, and this cycle is repeated until the hole is completed.

Crankshafts are located horizontally in the deep-hole drilling machines, and clamped by four hydraulically operated elevator clamps. At the completion of the drilling cycle, the crankshafts are automatically unclamped and lowered into position for unloading.

In less than one year of operation, the number of crankshafts drilled per machine has increased

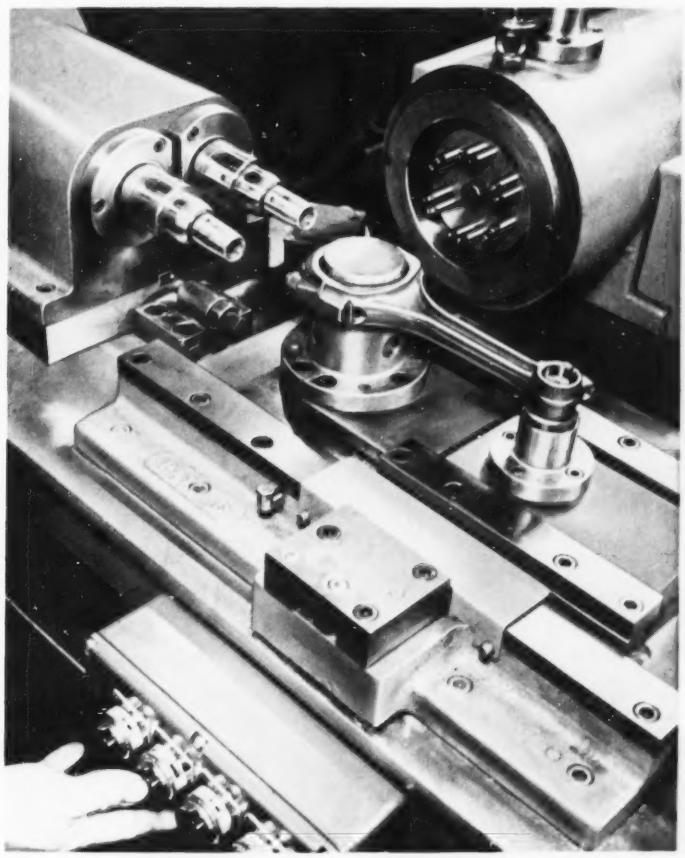


Fig. 12. Nuts are loosened, caps are lifted from bolts, and mating rods and caps are stamped on this semi-automatic machine.

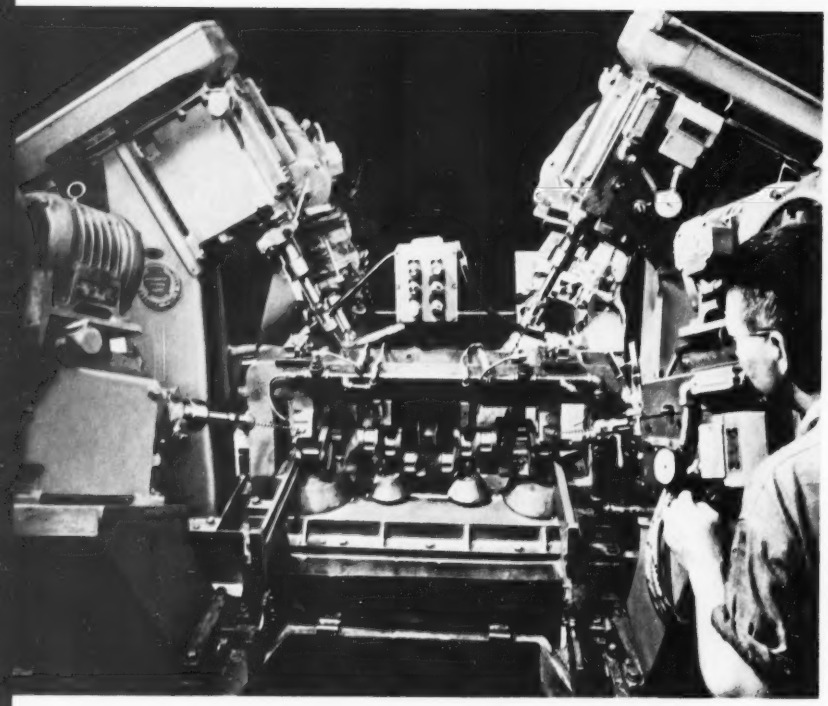


Fig. 13. Six angular, oil lubricating holes, 1/4 inch in diameter by approximately 5 inches deep, are drilled in the crankshaft on this machine.

60 per cent, and the life of the twist drills has been tripled by employing specially ground drills and carefully controlled operating conditions. The high-speed steel drills are carefully ground to a special chisel point, having a 130-degree included angle and thin web, on Oliver drill sharpening machines. Spindle speeds are standardized at 585 R.P.M., and the drills fed 0.0033 inch per revolution. A copious supply of coolant is employed. The drills, held in special, quick-change three-jaw chucks, are changed after drilling twenty-five crankshafts.

The six crankpin bearing surfaces on each crankshaft are finished on Landis semi-automatic hydraulic grinding machines such as the one shown in Fig. 14. The crankshaft is chucked on the front and rear main bearings, and located and driven from a pad on the rear counterweight. Finish-grinding of the pin bearings is completed with three positionings of the crankshaft, accomplished by indexing the work carriage to align two pins with each indexing.

Automatic cycling during crankpin grinding eliminates eight manual operations, and insures more uniform quality. When the grinding wheel has been positioned, it is automatically fed at several different rates until the pin is 0.015 inch over size. Then the operator places a Foster

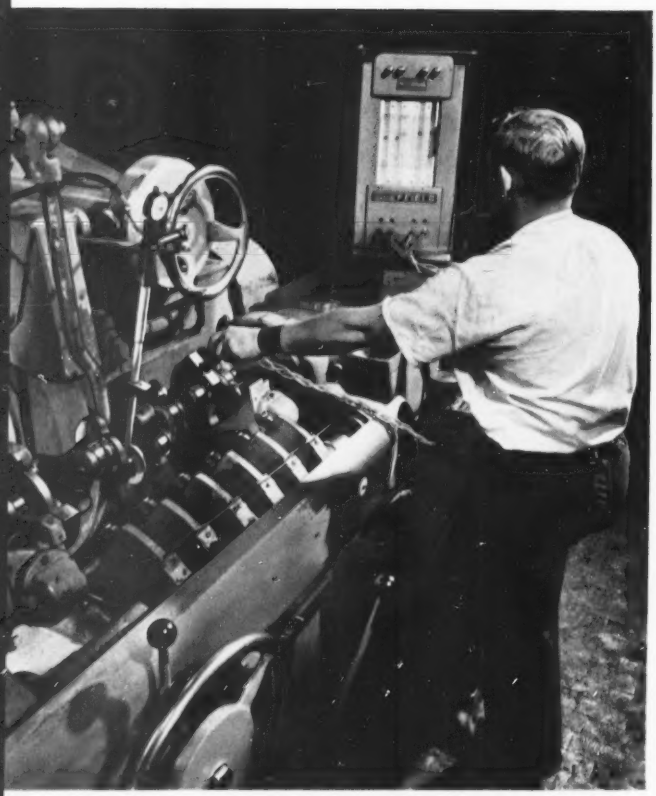


Fig. 14. Semi-automatic, hydraulic grinding machine for finishing pin bearings on crankshaft has automatic size control and changes in feed rates.

sizing indicator in contact with the pin and the automatic feed is resumed at a reduced rate. When the pin is of the required size, wheel feed is automatically halted and a timer is actuated to control the spark-out. After this pre-set time, the wheel-head automatically moves away from the work, the feed is reset, and work rotation is stopped.

Vitrified-bond, aluminum-oxide abrasive wheels of 54 grain size are employed to remove about 0.050 inch of stock from each crankpin diameter. The wheels are initially 42 inches in diameter by 1.280 inches wide, and can be employed until they are reduced to a diameter of 30 inches. The driven sheave is changed as the wheel size decreases to maintain a surface speed of 8500 feet per minute. Crankpin diameters are ground to within plus or minus 0.0005 inch of the required size, and Sheffield Precisionaire gages are provided at each machine to check the sizes. The 30-inch diameter abrasive wheels are subsequently used to grind camshafts.

The peripheries of inlet and exhaust valve guides are ground and automatically sized with practically no handling of the parts. The rough castings, made from a close-grained cast iron having a Brinell hardness of about 200, are delivered to a hopper which automatically feeds them into the first of four Cincinnati centerless grinding machines. V-type roller conveyors serve to transfer the parts between successive grinders. The first two grinders each remove about 0.020 inch of stock from the guide diameters, the third grinder removes 0.010 inch, and the fourth approximately 0.002 inch, to produce finished guides having a diameter of between 1.5635 and 1.5650 inches.

After the guides leave the last centerless grinding machine, they pass through an air manifold ring having internal jets which blow coolant from the work-pieces. The guides then slide through an Arlin electronically operated sizing unit and segregator, Fig. 15. Valve guides within the required limits are passed straight through into a tote pan, while those over or under size are ejected into boxes on both sides of the segregator. A set of lights also indicates whether each part has been accepted or rejected, thus showing the operator of the grinding machine whether adjustments are necessary.

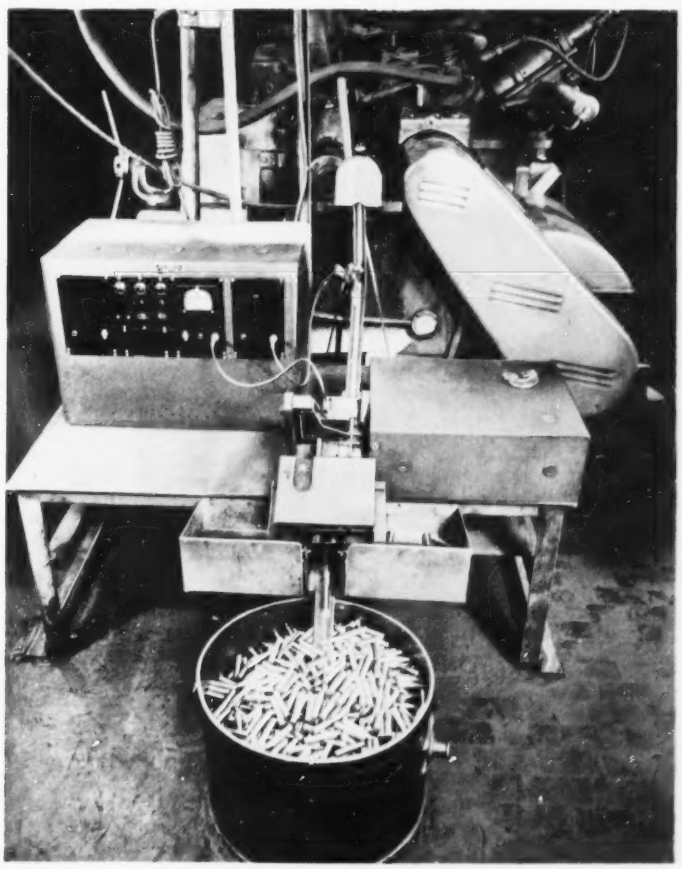


Fig. 15. Electronically operated sizing unit and segregator passes acceptable inlet and exhaust valve guides, and rejects those that are over or under size.

Casting

The ancient art of plaster casting has been greatly improved, and is currently being used to mass-produce cast aluminum-alloy torque converter parts for automatic transmissions, maintaining close control of critical dimensions and providing smooth surface finishes

By CHARLES H. WICK
Associate Editor

PLASTER methods of casting have been practiced for centuries, but it is only in recent years that important improvements have made it possible to adapt the process to production uses. With refinements in technique developed by the Aluminum Company of America, the plaster method is now an efficient process combining the intricacies of sand casting with the smooth surface finishes and dimensional accuracies obtained in die-casting.

As a result, Alcoa has set up special foundry facilities in Detroit, Mich., for the mass production of cast-aluminum torque converter parts for automatic transmissions. Typical of such parts now being cast with plaster cores are the ones seen in Fig. 1. From left to right in the top row are a first turbine, rear stator, and reactor wheel; in the same order in the bottom row are a second turbine, pump, and front stator wheel. The number of blades on various torque converter parts varies from nineteen to thirty-five, the first turbine for one automatic transmission having twenty-eight blades. A 10-pound casting about

Torque Converter Parts with Plaster Cores

14 inches in diameter is the largest part now in production at the Detroit Works. However, parts up to 300 pounds in weight and over 40 inches in diameter are being cast experimentally.

The intricately formed blades on these torque converter parts require close dimensional accuracy to eliminate costly machining and finishing operations, and insure proper operation when rotated at high speeds. Also, their surfaces must be extremely smooth so that little or no resistance is offered to the flow of oil. Otherwise the operating efficiency of the torque converter will be reduced. With plaster core casting, the shape and size of the oil passages formed between the blades—which are most critical—are maintained within plus and minus 0.005 inch.

In addition to the smoothness and accuracy obtained, there are other advantages of the plaster method of casting. Since the dried plaster has less chilling action on the aluminum being cast than a sand or metal mold, thinner sections can be cast than with the normal sand or permanent mold process. Also, the dimensions of the casting, which are affected by metal contraction, are more easily controlled with plaster cores than with sand cores.

The plaster cores that form the torque converter blades are made substantially from a mixture of industrial casting plaster and water. The slurry is made in small quantities at a time, using an electrically operated, batch type mechanical mixer. Plaster is carefully weighed for each batch, and the amount of water to be added is measured by an electrically controlled device.

Molds for forming the plaster cores are made from a thermosetting phenolic casting resin having exceptional dimensional stability. First, accurate master molds are made which have the exact shape and size of the required oil passages between the blades. By suitable transfer methods, the plastic molds are developed from these masters. Liquid resin used in this process requires a curing treatment as a final operation. All the molds are of two-piece construction. Some have open bottoms and are placed on metal plates for pouring, while others have a flange on one-half of the mold which forms the bottom plate when the parts are assembled.

The plaster mix is poured into the cavities of the plastic molds, illustrated in Fig. 2. The slurry readily flows into the finest details of the plastic pattern. Filled molds travel on an endless belt conveyor, during which time the water combines with the plaster in a chemical reaction—the plaster taking on its set and becoming hard enough to hold its shape.

At the completion of this setting cycle, the molds are removed from the conveyor and opened, Fig. 3. As the plaster cores are removed from the mold, they are carefully inspected for air holes, scratches, or other imperfections. Broken or defective cores are discarded, while those passing inspection are stacked in wooden trays for curing.

The plastic molds are returned to the pouring position on a parallel conveyor (Fig. 4) that carries them through an automatic washer and dryer. At the end of this conveyor the molds are removed, reassembled, and again filled with plaster mix. The molds have an extremely long life because the soft plaster offers little pressure, abrasion, or shock.

Plaster cores are stacked in wooden trays on portable racks and are placed in gas-fired, batch type, low-temperature ovens for curing or drying. During curing, the excess or free water needed for pouring the plaster into the molds is removed. After curing, the plaster cores are reinspected, cleaned, and assembled with sand cores, as seen in Fig. 5. (The core being assembled in this illustration will be used to cast the first turbine for a torque converter.

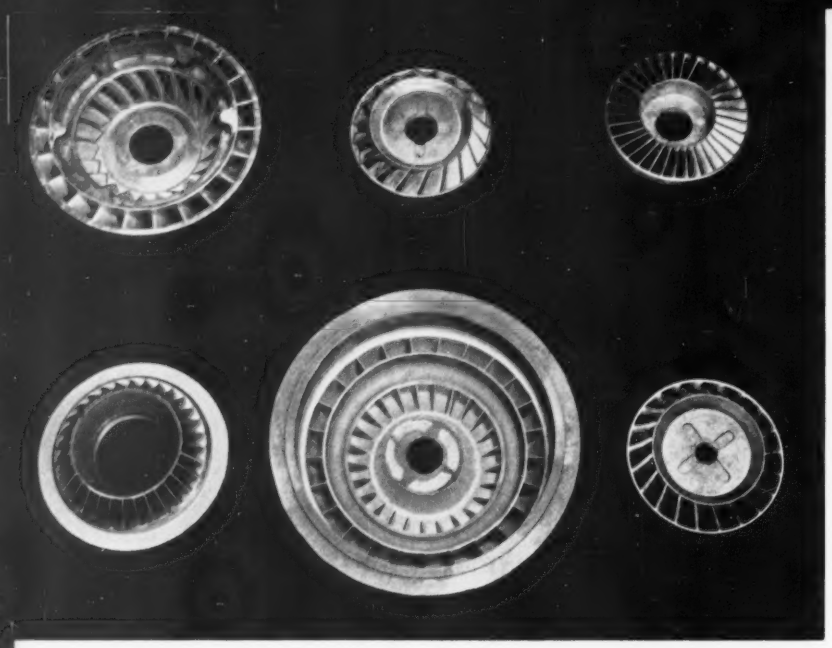


Fig. 1. (Left) Cast-aluminum converter parts for automatic transmissions. The parts contain from nineteen to thirty-three intricately formed blades.

Fig. 2. (Below) Carefully controlled mixture of industrial casting plaster and water is poured into the cavities of the plastic molds.

For the assembly of the plaster core components, the dry sand cores are placed on plastic or aluminum fixtures, and ribbons of glue are applied on the sand core surface. The operator inspects each plaster core and wipes it off with a brush or simply with her fingers before placing it in position on the glued surface. After assembly, and just before casting, the core is again dried in a low-temperature, gas-fired oven to remove any moisture that might have been absorbed during assembly or storage.

Conventional sand foundry practice is employed in making molds. Patterns are mounted on plates and placed in a jolt-squeeze (molding) machine. After removal from the machine, the mold is rolled over through 180 degrees and the assembled sand and plaster cores are manually inserted, Fig. 6. The upper half or cope section of the mold is then assembled to the drag, and molten aluminum alloy is dipped from a gas-fired furnace and poured, as seen in Fig. 7.

Most of the torque converter parts for automatic transmissions are cast of Alcoa 319 alloy, containing 3.5 per cent copper, 6.3 per cent silicon, and the balance aluminum plus normal impurities. Alcoa 355 alloy is also used for certain of the parts, particularly for the larger castings. This alloy contains 5 per cent silicon, 1.5 per cent copper, 0.5 per cent magnesium, with the balance aluminum plus normal impurities.

Molds containing the cast-aluminum torque converter parts remain on a conveyor for about fifteen minutes—a sufficient length of time for the aluminum to solidify and cool, thus permitting handling without breaking. The molds then roll onto a vibrating shake-out table, Fig. 8, where most of the sand and some of the plaster are removed and fall through openings in the

Fig. 3. After setting, plaster cores are removed from molds and carefully inspected. Cores with air holes or other imperfections are discarded.

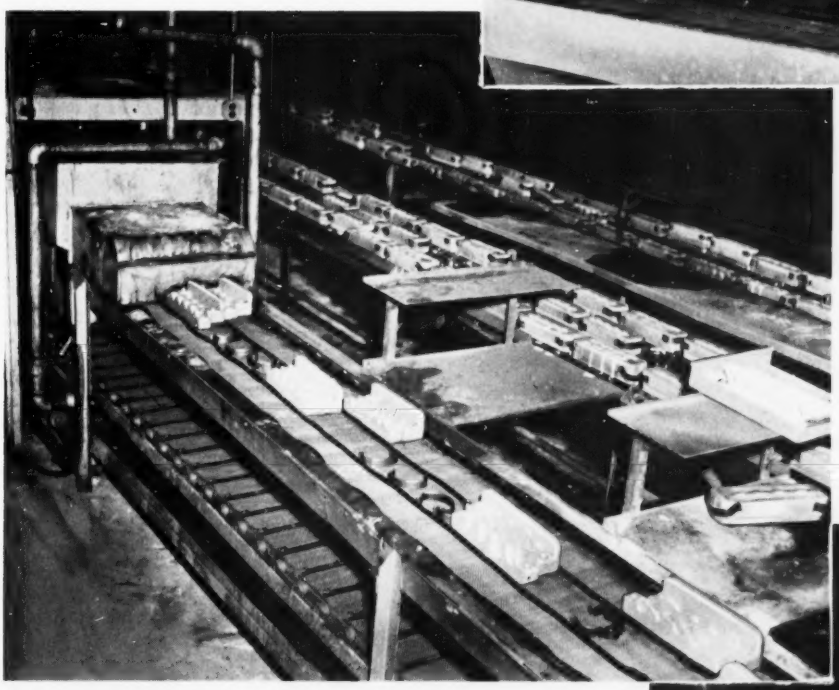


Fig. 4. (Left) Plastic molds are returned to the pouring position on a conveyor that carries them through an automatic washer and dryer.

table. The sand can be reclaimed and used again, but the plaster is discarded. The castings are placed in portable containers and conveyed to the trimming room.

In the trimming room, gates and risers are sawed or cut from the castings. On the larger castings, the gates are removed by band-sawing and grinding, while smaller castings are rough-trimmed on lathes. All castings require some hand finishing. Plaster and any remaining sand in the castings are knocked out by hand or by a pneumatic vibrator, or are blown out by air.

The set-up on an automatic lathe for trimming

Fig. 5. After curing in an oven, the plaster cores are reinspected, cleaned, and assembled to sand cores by means of glue.

Fig. 6. Here, combination sand and plaster cores are inserted in sand mold drag. Then cope section of the mold is assembled to the drag.

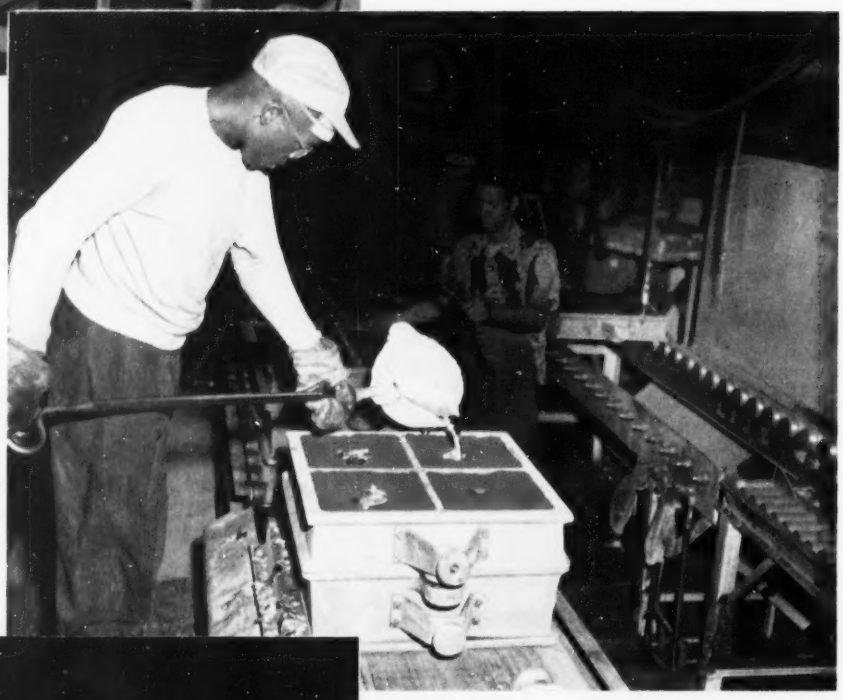


Fig. 7. (Right) Molten aluminum alloy is dipped from gas-fired holding furnace and poured into mold.

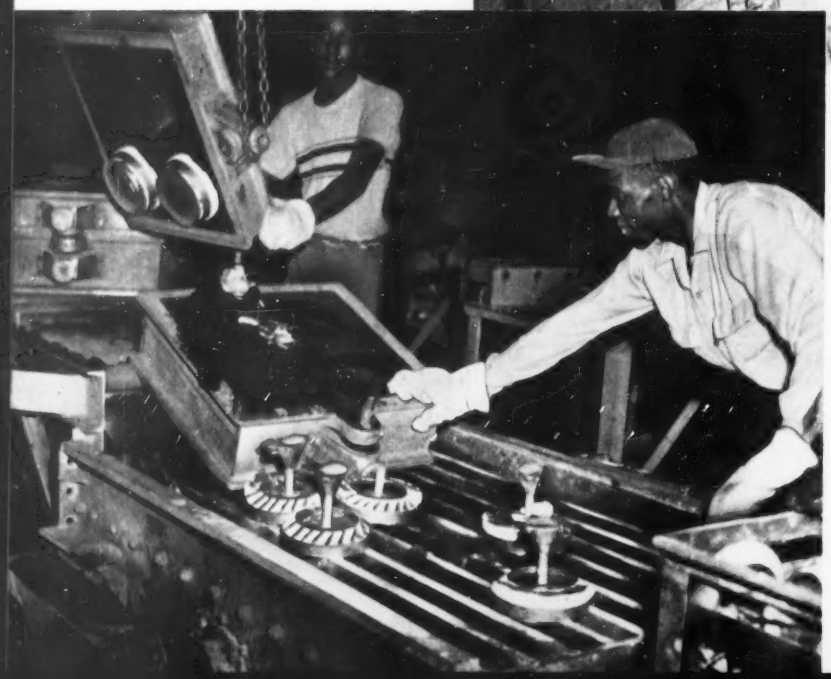


Fig. 8. Castings are shaken out of molds onto vibrating table. Most of the sand and some of the plaster fall through openings in the table.

Fig. 9. Flash is trimmed from castings by facing tools, the periphery and a shoulder are turned, and the bore is drilled on this lathe.

flash from one of the smaller torque converter stator wheels is shown in Fig. 9. Three carbide-tipped tools are provided on the rear cross-slide of the lathe to face both sides and trim flash from the casting. A high-speed steel twist drill and two more carbide-tipped single-point tools are mounted on the main slide to drill the center hole, and turn the periphery and a shoulder.

Pump members of the torque converter units are pressure tested in the tank shown in Fig. 10. The pump casting is clamped pneumatically to a special work-holding fixture, and compressed air under a pressure of 100 pounds per square inch is introduced into the casting. Then the casting and fixture are immersed in an illuminated tank of water. If any bubbles are detected on the surface of the water, the casting is rejected.

Cleaned and inspected castings are stacked in metal baskets, and remain in these baskets during heat-treatment and shipment to the customer's plant. The customer removes castings as required, and returns the empty baskets.

The standard heat-treatment for torque converter castings consists of artificially aging or stabilizing, and is designated –T5. Such treatment improves the mechanical properties and the machinability, substantially relieves stresses set up in casting, and increases dimensional stability. The treatment consists of maintaining the castings at a temperature of 400 degrees F. for eight hours and cooling in air. This treatment provides a minimum tensile strength of 25,000 pounds per square inch with a typical hardness of 80 Brinell, as determined on test bars.

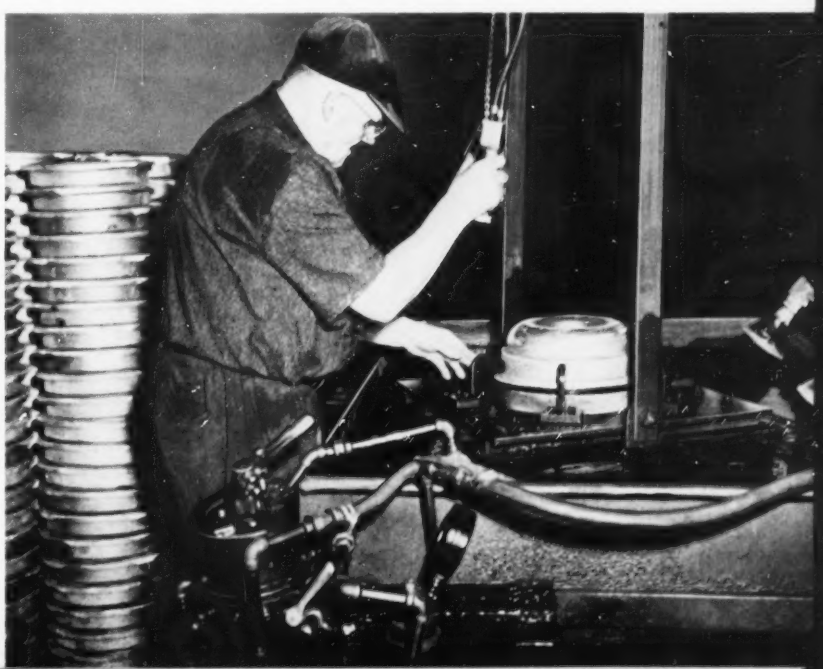
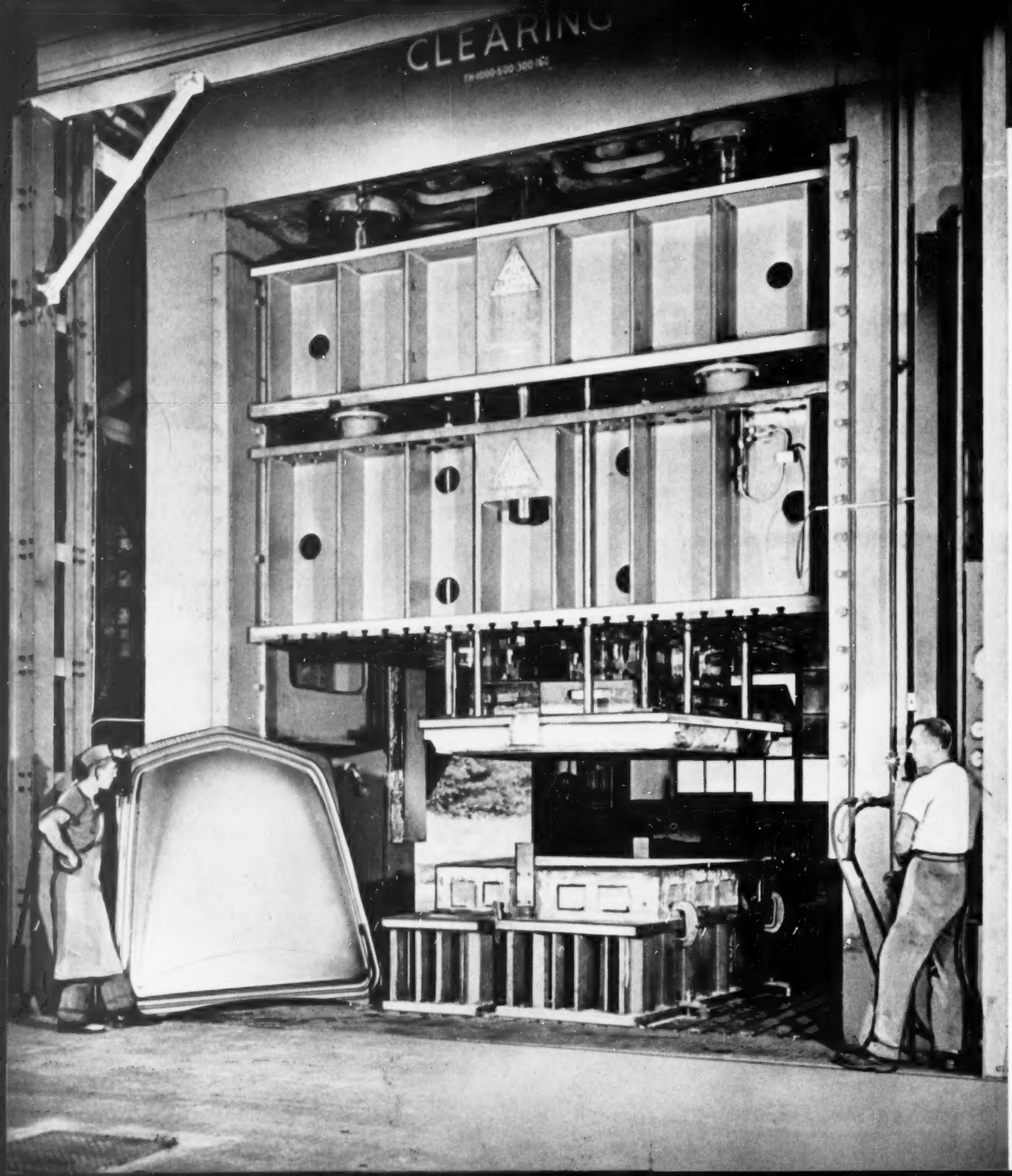


Fig. 10. Pump members of torque converter units for automatic transmissions are pressure tested by immersing in illuminated tank of water.

Plastic Dies

By W. CURTIS MILLER, Plant Manager, and
W. J. ESDALE, Manager, Allite Division
Allied Products Corporation
Allite Division—Plant 4
Hillsdale, Mich.



Speed Delivery of Experimental Stampings

EXPERIMENTAL stampings, as well as full-size prototype stampings for automobiles of advanced design, can be produced more rapidly and at lower costs by employing lightweight, easily made plastic dies. While plastic dies have been used for several years in the aircraft industry, it is only recently that they have been applied in the automotive field.

At the Hillsdale, Mich., Plant 4 of Allied Products Corporation, draw dies for prototype and experimental stampings are being made from a non-shrinking, thermosetting phenolic resin. In addition to the advantages mentioned, substantial reductions in weight are obtained, particularly on large dies. Also, since the plastic used for the dies has exceptional dimensional stability with negligible distortion, close tolerances can be maintained from exact-size patterns. Therefore, the need for over-size patterns to allow for shrinkage of the die is eliminated.

Because of the close tolerances to which the plastic dies can be cast, little finishing is required. Plastic dies need simply to be spotted together and placed in operation. Development of the draw can be established when plastic dies are employed, and correct die design—as well as proper operation—is insured before the permanent steel dies are made. Also, alterations of the die due to changes in the design of the stamping, or repairs necessitated by damage to the die, can be quickly and easily taken care of by removing the excess plastic or casting additional resin directly on the punch or die, or to ring surfaces.

Typical of the many plastic dies that have been made by Allied Products Corporation is the one shown in Fig. 1 for drawing automotive flywheel housing covers from 0.040-inch thick steel blanks. The covers are approximately 10 inches long by 6 inches wide, and are drawn to a depth of 5 inches. Both punch and die are made from solid plastic, while the draw-ring is made from Kirksite. The experimental die seen in Fig. 2 was made in the same way. With this die, 0.028-inch thick steel blanks are drawn to a depth of 2 inches. The stamping, 18 inches long by 6 inches wide, is then cut apart to produce the top and bottom of an assembly.

The largest plastic die made to date is the one seen in Fig. 4, which is employed to draw automobile hoods 64 1/2 inches long by 66 1/2 inches wide to a depth of 9 inches from steel blanks 0.042 inch thick. As shown in the cross-sectional view of this die, Fig. 3, the plastic is held in a Kirksite (zinc alloy) container. This type construction is now used on all plastic dies made at Allied Products Corporation since the zinc alloy is more economical than steel weldments and cheaper than an equivalent volume of plastic. Also, the die is much stronger, and there is less danger of the plastic breaking, as occasionally used to happen in dies when the plastic was unsupported. If the die is no longer needed, the Kirksite is remelted for future use.

This huge plastic hood die is seen in the heading illustration, mounted in a Clearing 1500-ton, triple action hydraulic press that was specially designed for this type work. The press has a 60-inch stroke, a 100-inch daylight opening, and a bed area 96 by 160 inches.

The non-shrinking, thermosetting, liquid phenolic resin employed for these dies is Tool Plastic made by Rezolin, Inc., Los Angeles, Calif. This plastic is mixed cold and readily poured without pressure into the molds. When hardened in the presence of heat, the plastic becomes insoluble and cannot be resoftened. The cured plastic has a hardness of 110 Rockwell R, a compressive strength of 11,000 pounds per square inch, and

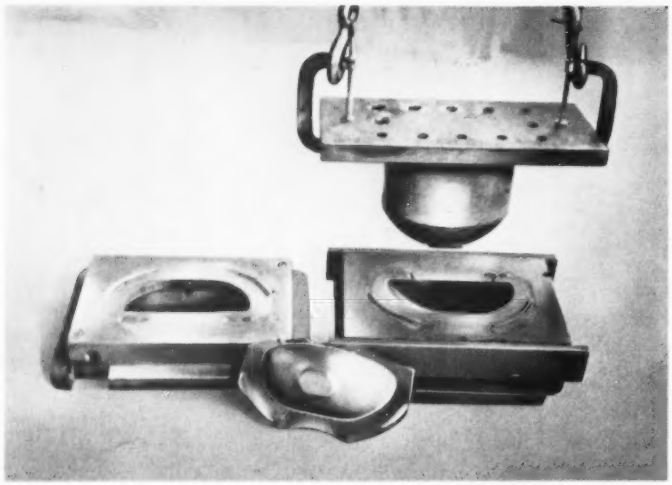


Fig. 1. Plastic punch and die and Kirksite ring for drawing 0.040-inch thick flywheel housing covers to a depth of 5 inches.

a tensile strength of 5000 pounds per square inch. Its weight is 0.045 pound per cubic inch.

Patterns or models for the plastic dies are usually made of wood or plaster, although plastic or metal models can be used. After developing the binder line and necessary run-offs, a plaster mold for making the plastic punch is cast directly against the model employing conventional shop practice. Industrial casting plaster (U. S. Gypsum Hydrocal) is used for this splash mold, the plaster having a wall thickness of from 1 to 2 inches and being reinforced with hemp.

The plaster mold is force-dried in a gas-fired oven maintained at a temperature of 120 degrees F. Thorough drying of the plaster is essential because any moisture present will cause soft surfaces on the plastic die. Several coats of sealer are sprayed on the mold, as seen in Fig. 5, sanding lightly between coats with No. 400 sandpaper. Then two thin coats of a plastic-base lacquer (Inter-Chemical Corporation Blue Mold) are sprayed on the plaster to produce a high gloss and prevent adherence of the plastic. The mold surface can also be lightly coated with a wax, such as Simonize, to facilitate removal of the plastic coating.

Wood patterns for the containers are then made. The containers are designed with sufficient Kirksite to provide a fairly uniform thickness of plastic—varying roughly from 2 to 2 1/2 inches, depending on the application of the die. It is neither essential nor economically feasible to have the surface of the Kirksite closely approximate the contour of the required die surface, and for these reasons the plastic may vary in thickness up to 4 inches.

When the container pattern has been removed from the sand mold and prior to pouring the

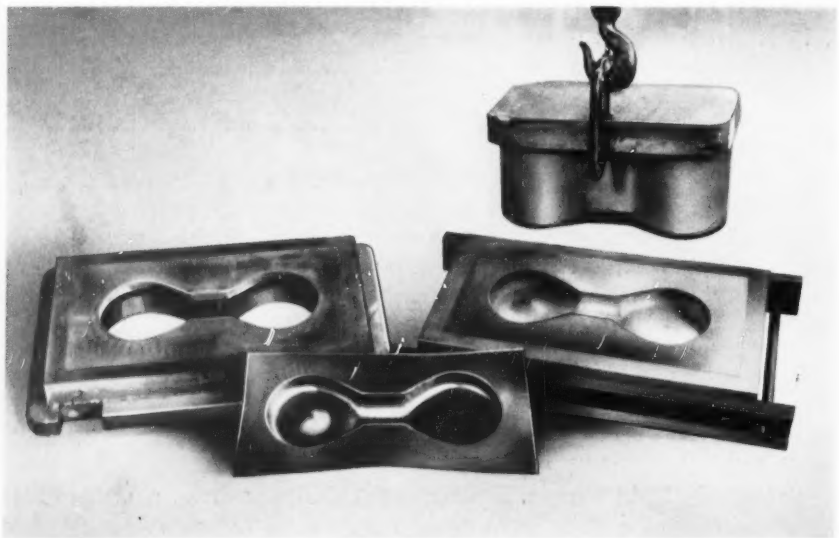


Fig. 2. Two halves of an assembly are produced in a single stamping from 0.028-inch thick steel with this die.

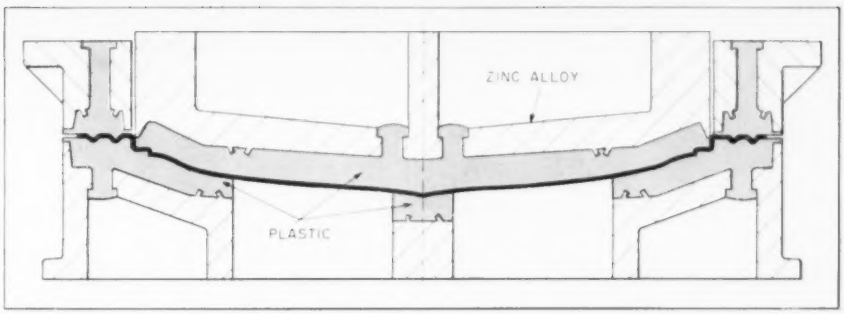


Fig. 3. A sectional drawing of die shown in Fig. 4. Plastic punch and die are held in Kirksite tubs.

Kirksite, holes approximately 3/8 inch in diameter are drilled at various angles in the sand. Thus, plugs project from the surface of the cast container, as seen at the top in Fig. 6, and serve as mechanical locks to anchor the plastic. The surface of the container and the walls of the plaster mold against which the plastic is to be cast are coated with an anti-corrosive paint to prevent attack by the acid accelerator used in the plastic mix.

The plaster mold is leveled on a surface plate and the zinc-alloy container is suspended in position over the plaster from I-beams which rest on parallel risers of uniform height. Openings around the edges of the assembly are sealed with tape, plaster, and hemp to prevent leakage of liquid plastic. Mixed plastic is poured through a spout and flows through the large pouring holes cut in the container into the lowest points in the space between the container and plaster mold. When the liquid plastic becomes visible at the top of vent-holes (which allow the release of trapped air), pouring is stopped as the cavity has been filled.

The resin is mixed in the ratio of 100 parts of Tool Plastic to 25 parts of an accelerator paste, the ingredients being measured by weight. A conventional dough mixer is employed to stir the mix until all the paste has been dissolved and a smooth, creamy consistency is obtained. The mix should be poured immediately. When pouring into confined areas, high pouring gates and risers should be employed to increase the head pressure and force out entrapped air.

After pouring the plastic, the assembly is allowed to set at room temperature for twelve to twenty-four hours, the exact time depending on the thickness of the plastic and the heat transfer properties of the mold. Then the assembly is moved into a gas-fired oven maintained at a temperature of 180 degrees F. for twenty-four to forty-eight hours. Longer curing cycles general-

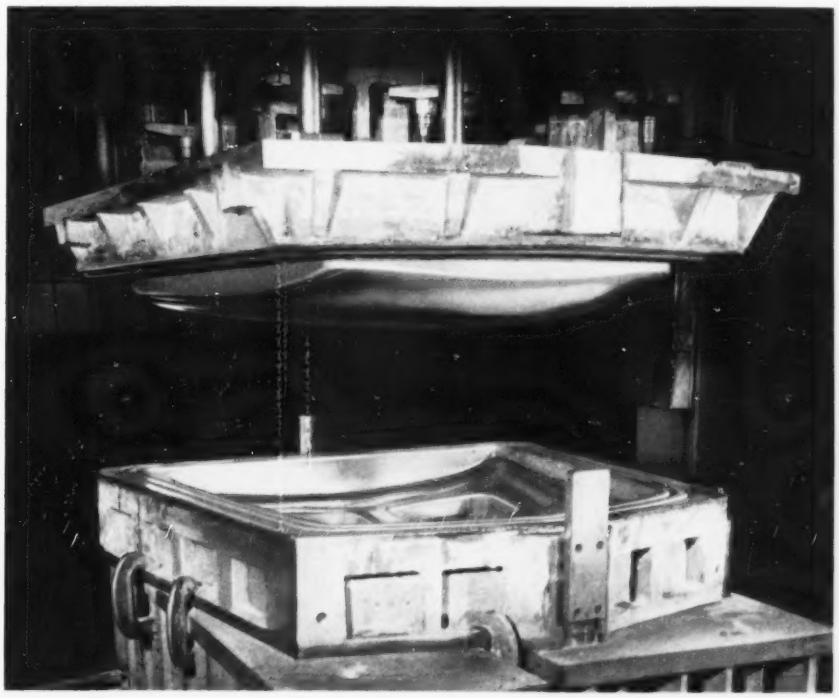


Fig. 4. Close-up view of the die employed to draw hoods which are 61 1/2 inches in length by 66 1/2 inches in width.

Fig. 5. Plaster mold, into which plastic is poured in making punch, is sprayed with several coats of sealer, sanding between each coat.

ly result in improved dimensional control, but excessive heating may cause the plastic to boil and become porous. Under-curing may result in unstable plastic dies. After reducing the oven temperature, the assembly is removed and allowed to cool to room temperature. The assembly should not be removed from the oven too soon, as sudden changes in temperature of the assembly could cause warping.

The plastic punch, with the integral container, is removed from the plastic mold, and any necessary finishing is performed. Flash and any surface irregularities are removed with sandpaper, hand files, or grinding discs. Surfaces of the plastic punch can be polished with wet sandpaper or buffed with Tripoli compound. Although it is seldom required, the plastic can be machined with light cuts at high speeds. However, cuts should be made toward the center of the die to prevent breaking away the edges.

Plastic pressure pads or binder rings are made by the same method as the punches—first making a plaster mold from the pattern, producing a Kirksite container, and pouring the liquid plastic. Wax sheets of the same thickness as the material to be drawn are cut and fitted to the surfaces of the binder ring and punch, as shown in Fig. 6, and the waxed surfaces are painted with a primer sealer. After making the cast die container, it is placed in an inverted position over the binder ring and punch assembly, and openings around the edges of the assembly are sealed. Required gate and riser tubes are then assembled, and the plastic is poured, Fig. 7, and cured, Fig. 8. Upon disassembly, the wax is stripped from the plastic punch and binder ring, and the plastic die is cleaned and checked. The die is then assembled and planed parallel top and bottom for fitting to the ram and bed of the press. Vent-holes must be drilled through the

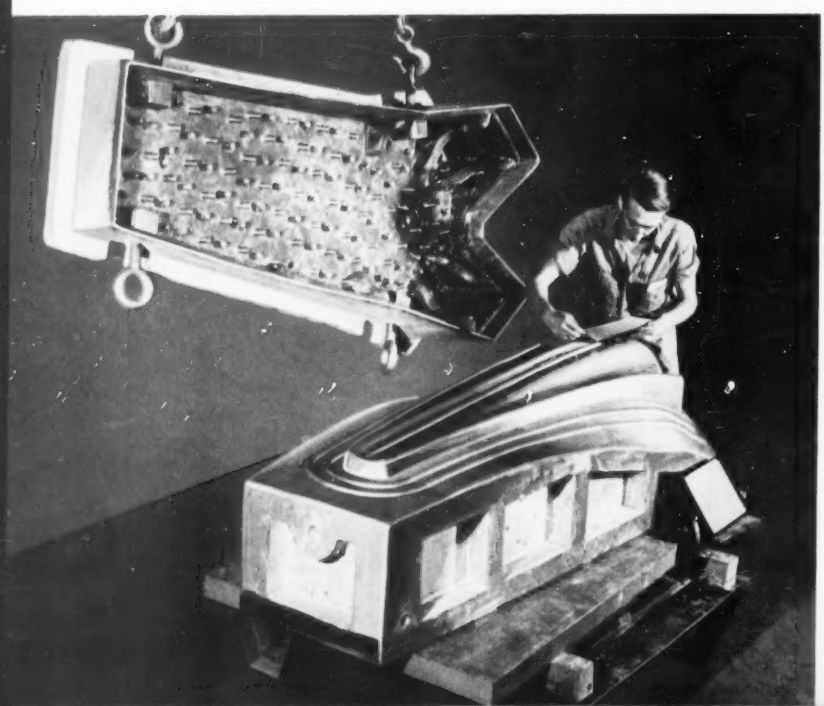


Fig. 6. Wax sheets having the same thickness as the material to be drawn are trimmed and fitted to the binder ring and punch assembly.

Fig. 7. Thermosetting phenolic resin, mixed with an accelerator, is poured into container and punch and ring assembly.

plastic punch and die to eliminate air traps during operation.

After any minor fitting that might be required, the plastic die is ready for operation in the press to produce the required number of experimental or prototype stampings. Conventional drawing die lubricant can be employed, but the hard, smooth working surface of the plastic die enables the metal to flow with a minimum of drag.

Reworking, repairing, or building up of additional plastic on the dies can be quickly accomplished with a "Quick-Set" resin accelerator. When this accelerator is mixed with the plastic, it will set hard at room temperatures in about two hours and bond with the original plastic casting. The surface of the plastic die must first be thoroughly cleaned, then roughened with coarse sandpaper (or chipped out), and washed with acetone.

Fig. 8. Sealed assembly, consisting of container and punch and ring filled with poured plastic, is moved into gas-fired oven for curing.

Transfer presses, progressive dies, thread-rolling, and other interesting set-ups are used to increase the production and lower the cost of manufacturing improved quality automotive accessories, such as air cleaners, speedometers, fuel pumps, oil filters, and spark plugs

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CONTINUED improvement in the quality of the products manufactured and the development of techniques for increasing production and lowering costs are the constant aims of engineers at the AC Spark Plug Division of General Motors Corporation. These aims are being achieved despite the wide variety of products manufactured—spark plugs, speedometers, fuel pumps, oil filters, air cleaners, and other automobile equipment—and their frequent changes in design.

Transfer presses, progressive dies, and thread-rolling operations are some of the means devised to produce higher quality parts at lower cost. These and other interesting set-ups employed at the Flint, Mich., plants of AC Spark Plug will be described in this article.

Outer shells for oil filters are produced from round blanks on a Verson 450-ton mechanical press of the transfer type. Eight operations are performed simultaneously, and a completed shell is produced with each stroke of the press. Round blanks are stacked in a three-station automatic feeder, seen in Fig. 1, located at the right-hand

Producing Automotive Accessories by Cost-Cutting Methods

end of the press. A suction cup lifts one blank at a time to the proper level for it to be transferred into the press, the blanks being separated from each other by magnets. When all the blanks in one stack have been fed, the automatic feeder is indexed 120 degrees to bring another stack below the suction cup.

Parts are carried from station to station by a transfer feed mechanism having two horizontal bars equipped with work-gripping fingers, as shown in Fig. 2. The transfer bars move together in a rectangular path—first toward each other so that the fingers grip the work-pieces, then sideways to advance each part and locate it in the next station, then away from each other to release the parts, and finally back to their starting positions, where they are ready for the next cycle. Movement of the transfer bars is synchronized with the motion of the press ram.

As each round blank is transferred into the press (right, Fig. 2), its top surface contacts a finger connected to an electrical switch. If more than one blank is fed below the finger at the same time, the press is stopped. The top surfaces of the blanks are automatically coated with drawing compound, applied by means of air-operated, electrically controlled spray guns. At the first four stations, seen in Fig. 2, the blanks are successively drawn, redrawn, and struck. Then at the last four stations, shown in Fig. 3, the oil-filter shell is trimmed, pierced, hemmed, embossed, and stamped. With other methods of producing this part, several separate presses, each with an operator, would be required.

In another interesting application of a transfer press, two parts for air cleaners—an outer shell and an oil baffle ring—are made at the same time. The rings are obtained from the center portion of partially formed air cleaner shells. A rear view of the Verson nine-station transfer press on which these operations are performed is shown in Fig. 4.

Terne-plated steel coil stock, 0.019 inch thick, is fed into the transfer press. At the first station, seen at the left, the outer shell is blanked and drawn. The second station is idle. After transfer to the third station, the shell is redrawn and pierced. Striking of the air cleaner shell is performed at the fourth station.

Holes are pierced in the part and the central section, which is approximately 7 1/2 inches in diameter, is blanked out at the fifth station. This center portion is used for the air cleaner oil baffle. A sectional view of the die employed at this station is seen in Fig. 5. The cylindrical outer shell *A* remains in the transfer press for further operations, while the cylindrical oil baffle *B* is removed from the press.

Removal of the oil baffle for the air cleaner is accomplished by a swinging shovel type unloader mounted on the rear of the press, as shown in Fig. 4. As the press ram rises, the shovel is swung under the punch by levers connected to the ram plate, and the oil baffle falls on the shovel. When the ram again descends, the shovel is swung away from the die and the baffle slides into a stock tub.

At succeeding stations in the transfer press,

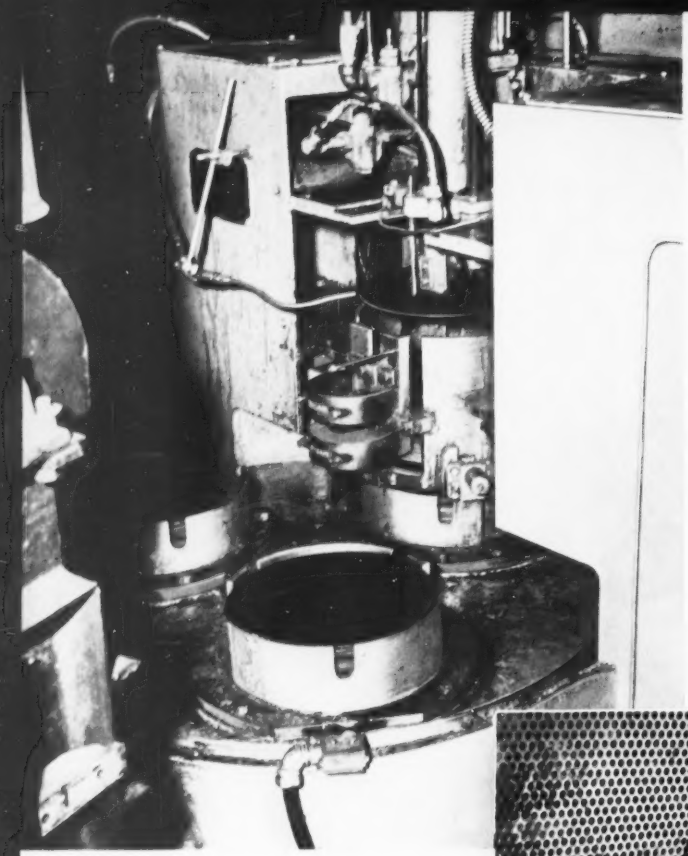


Fig. 1. Round blanks to be drawn into oil-filter shells are fed into press from three-station automatic feeder. A suction cup lifts the blanks.

the outer shell for the air cleaner is pierced, extruded, and trimmed. A narrow ring of metal trimmed from the inner edge of the shell at the sixth station is also dropped on the swinging shovel, and slides into a scrap bin.

A sectional view of the die employed at the ninth and final station for piercing side holes in the outer shells is presented in Fig. 6. As the press ram descends, a vertical-acting cam *A* mounted on the upper die slides the horizontal-acting cam *B* to the right. Punch *C*, secured to cam *B*, thus pierces the required hole in the side of the outer shell *D* of the air cleaner. Slug *E* is pushed through the bore of die bushing *F*

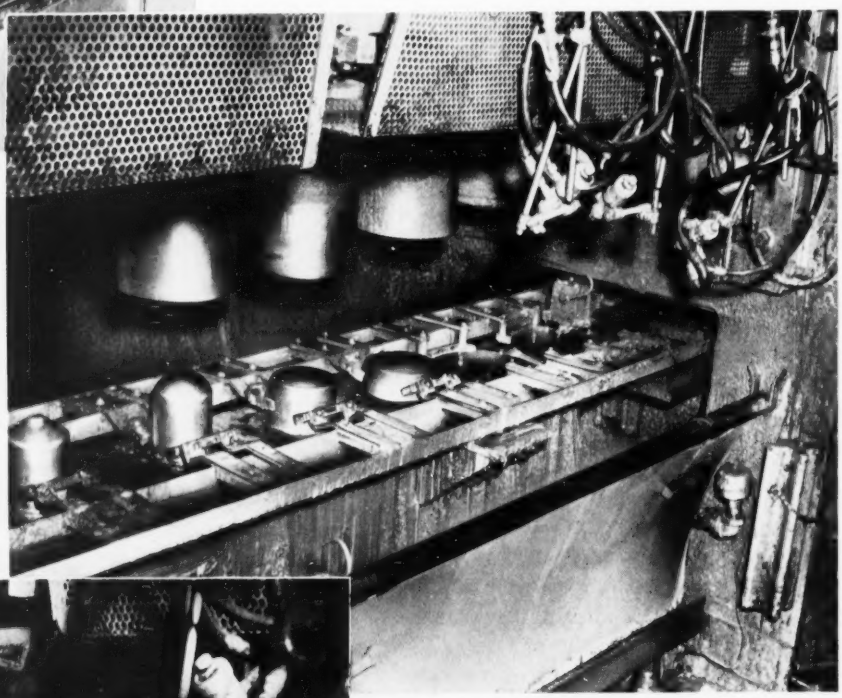


Fig. 2. (Right) At the first four stations of an eight-station transfer press, the round blanks are drawn, redrawn, and struck.

Fig. 3. In last four stations of the press, Fig. 2, oil-filter shells are trimmed, pierced, hemmed, embossed and stamped.

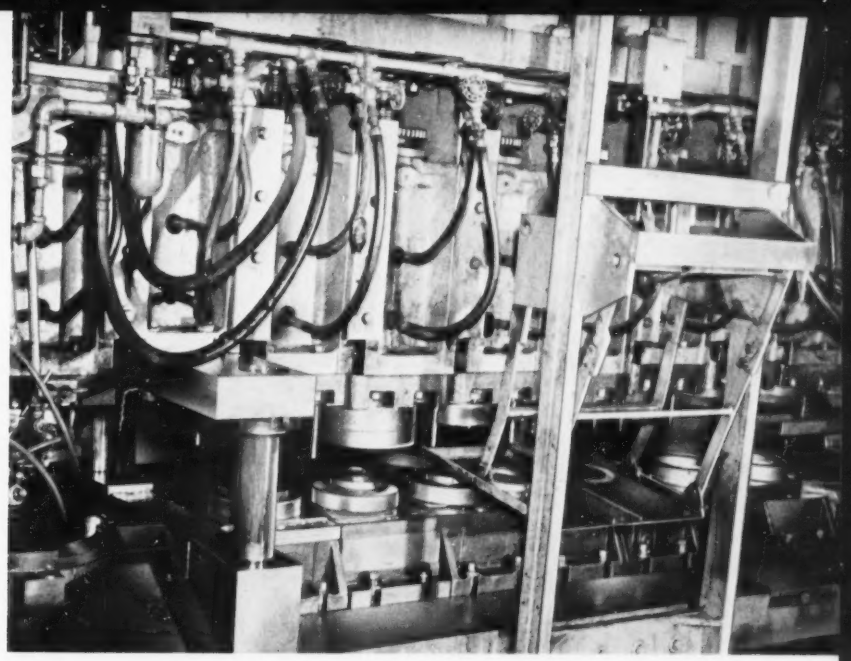


Fig. 4. Rear view of a nine-station transfer press on which outer shells and baffle rings are produced simultaneously.

and falls down through openings in die ring *G*, riser block *H*, and bedplate *J*. Cam *B* and the punch are returned to their starting positions as the press ram rises by the action of spring *K*. The completed outer shell is raised from the die for ejection by pin-actuated lifting ring *L*.

The quality of the speedometer cups produced at AC Spark Plug has been greatly improved by producing them on a Baird nine-station transfer press (seen in the heading illustration), which is directly connected to a washing machine and a trimming lathe. Thus, manual handling has been eliminated and the chances of scratching or distorting the thin-wall aluminum cups have been minimized.

A completed speedometer cup is shown at the lower right in Fig. 7, which is a sectional view of the die employed on the transfer press. Depth of the cup is between 13/32 and 7/16 inch when finished in the die, and is trimmed to the 0.375-inch dimension shown. Variation in this dimension on any one cup must not exceed 0.002 inch, and 0.005 inch from cup to cup. The center hole in the cup must be concentric with the outside diameter within plus or minus 0.002 inch.

Coils of 0.032-inch thick pure aluminum are fed into the front of the transfer press. At the first station, seen at the left in Fig. 7, disc *A* is blanked between punch *B* and die *C*. The parts are transferred from station to station by cam-

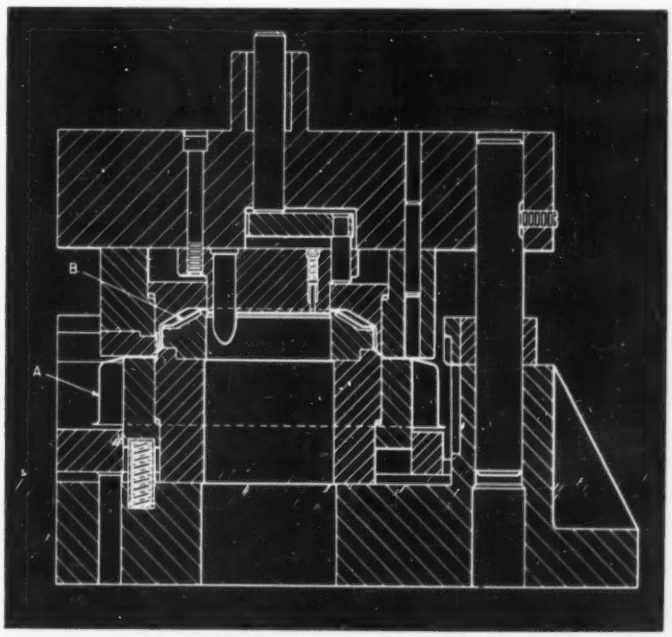


Fig. 5. Die used at fifth station of transfer press seen in Fig. 4. Outer shell is shown at (A) and the oil baffle ring at (B).

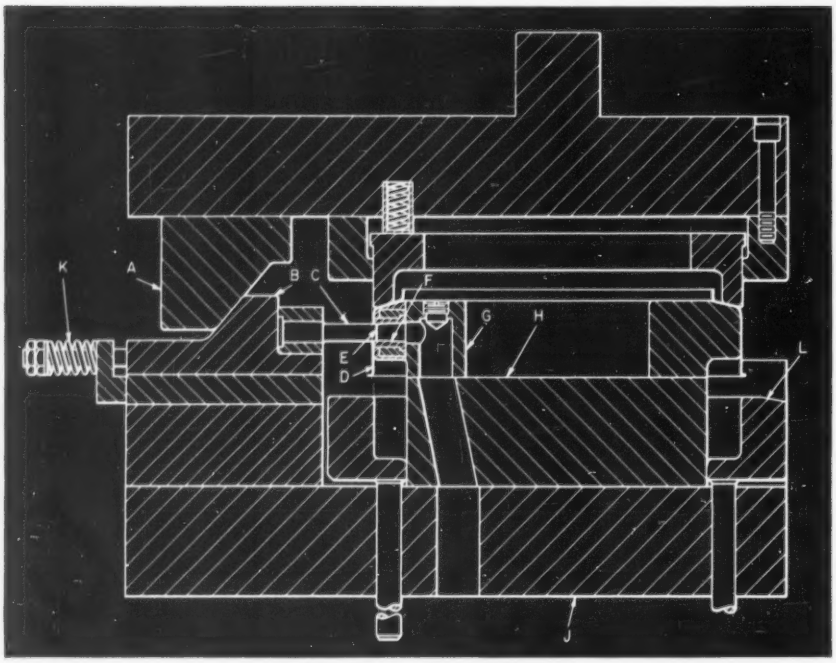


Fig. 6. (Left) Hole is pierced in side of air cleaner outer shell by means of cam-actuated, spring-loaded punch (C).

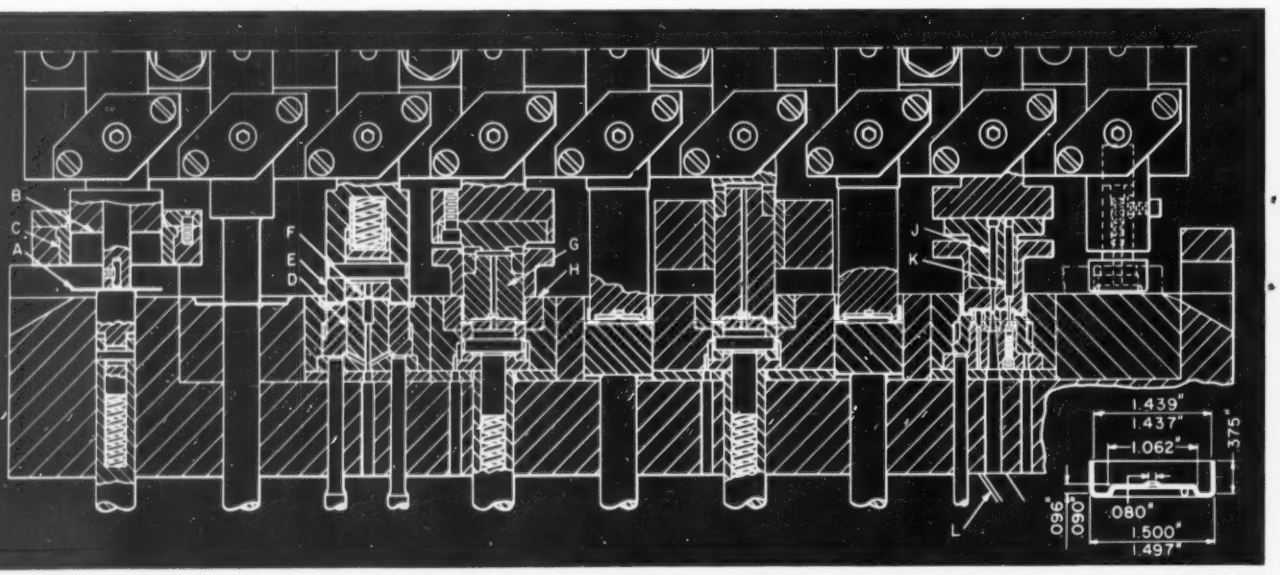
Fig. 7. (Below) Sectional view of die used to blank, draw, size, strike, and pierce speedometer cups from aluminum coil stock.

operated gripping fingers, not shown. Station No. 2 is idle, and at the third station the center portion of the blank is drawn upward by punch *D* into die *E*. When the press ram rises, the cup is ejected from the die by spring-loaded pad *F*.

After the part has been carried to the fourth station by the transfer fingers, it is formed into a cup by drawing the sides of the blank between punch *G* and die *H*. Since the wall thickness of the cup must be held within 0.001 inch total variation, the cup is sized and struck at the next three stations. At the eighth station, a hole 0.080 inch in diameter is pierced in the center of the cup by punch *J*, and a lug 0.093 inch high is formed by a beveled punch *K*.

Slugs from the holes pierced in the centers of the cups fall through the die and slide down chute *L* into a scrap pan. The slug chute is set into the bed of the press to permit removal of the die. At the ninth and final station, the speedometer cups are ejected. The cups fall down a chute located on the right-hand side of the press, and onto a conveyor passing through a washing machine.

From the washer, the speedometer cups enter a magazine, seen at the upper left in Fig. 8, for



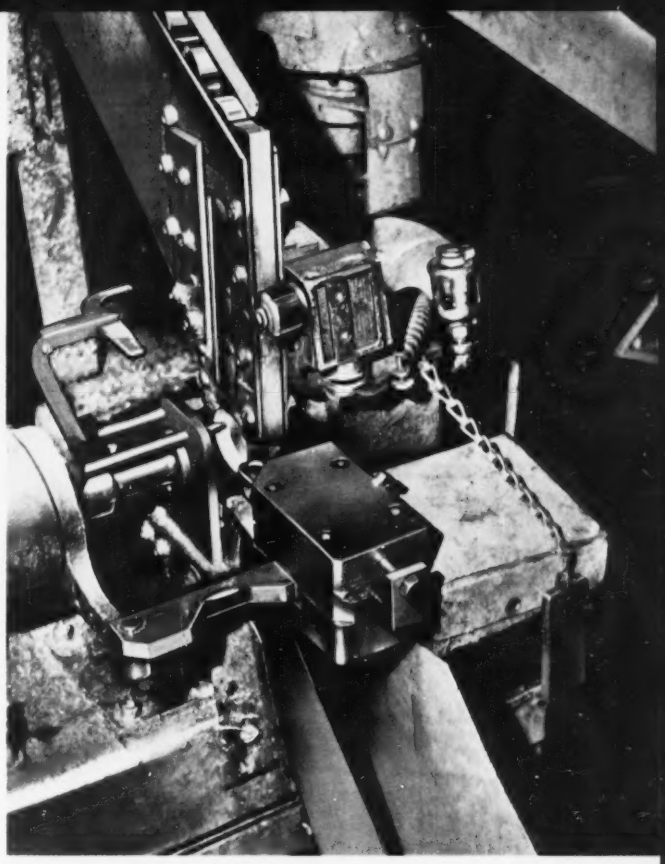


Fig. 8. Special lathe equipped with hollow tool for trimming edge of speedometer cup. Cups from washer enter magazine at upper left.

automatic loading of the special trimming lathe. This lathe, made by AC Spark Plug, has a standard Ex-Cell-O head for rotating the work-piece. A sharp-edged hollow trimming tool is clamped in the tool-block. This set-up permits the ribbon of aluminum trimmed from the cup to pass through the bore of the tool, and slide down a chute into a scrap pan. Also, when the cutting edge becomes dull, the tool only has to be rotated slightly to present a sharp edge to the work. When the entire cutting edge at one end of the tool has become dull, it is simply turned over and the opposite end is employed. Thus, considerable tool life is obtained.

Production increases of 300 per cent and better quality have been obtained by rolling the threads on speedometer worm-gears. With previous methods, only 300 to 400 parts could be produced per hour on each machine. Now 1200 gears per hour are completed on a single machine and, since the machines are equipped with hopper feeds, one man can operate several machines. A smoother, stronger surface is produced on the threads by rolling.

The speedometer worm-gears are made from S A E 1113 cold-drawn steel bar stock on automatic screw machines. Because the surface on which the worm threads are to be rolled must be maintained within plus or minus 0.0005 inch of the required size, this surface is both rough-formed and shaved. After cleaning with oleum spirits in a tumbling barrel, gear teeth are cut in the parts on a Barber-Colman automatic hobbing machine equipped with a magazine feed.

Then the worm threads are rolled on Reed circular die thread-rolling machines, such as the one seen in Fig. 9. For one gear, used to register miles on a particular speedometer, a double worm thread of 48 pitch and 25-degree pressure angle, with a right-hand helix angle of 77 degrees 41 minutes is rolled on the part. Since the pitch diameter of this worm thread is 0.1953 inch, the surface on which the thread is rolled is previously machined to a diameter of 0.1965 inch. Minimum length of full thread is 15/32 inch, and over-all length of the speedometer worm-gear is 1 3/4 inches.

Parts are placed in a Syntron vibratory hopper mounted above the thread-rolling machine. In the hopper, the speedometer worm-gears are

Fig. 9. Electrically operated vibratory hopper (top) feeds speedometer worm-gears into tube leading to thread-rolling machine (bottom).

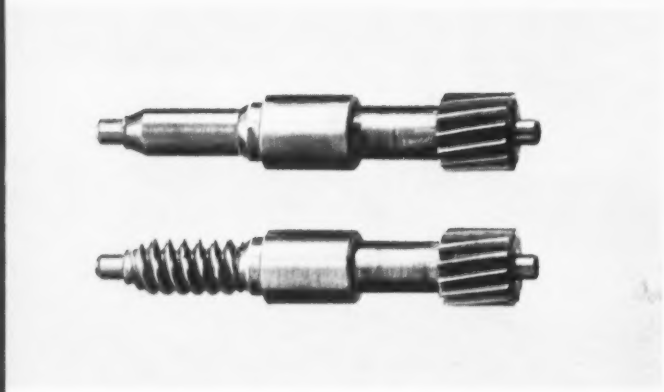


Fig. 10. Speedometer gear before and after rolling worm threads. Rolling is performed at the rate of 1200 gears per hour on machine seen in Fig. 9.

vibrated by electrical means, causing them to move clockwise and become aligned prior to entering a feed tube leading to the rolling machine. The gears are fed, one at a time, in a vertical position at the center of three hardened steel cylindrical dies. These dies rotate at equal speeds, and are cam-fed toward and then away from each other, thus displacing the metal on the surface of the gear into the required thread form. Completed speedometer worm-gears, such as the bottom one shown in Fig. 10, are automatically ejected from between the dies by a knock-out pin.

One of the many small parts required for the various products is a brass nut 0.156 inch in diameter by 0.070 inch long. In addition to tapping a No. 0–80 thread through the bore of this nut, it is necessary to mill two parallel flats on one end of the part, the measurement between the two flat surfaces being 0.086 inch. All operations are performed on the Brown & Sharpe automatic screw machine shown in Fig. 11, with a production of 800 nuts per hour.

Milling of the flats is performed with the unusual tool seen mounted at the top of the turret. With power taken from a Brown & Sharpe turret drilling attachment through a pinion and two spur gears, two correctly spaced slitting saws are rotated for the required milling operation. When this tool has been indexed into cutting position, rotation of the spindle and work are automatically stopped while milling is performed. Then spindle rotation is resumed and the completed nut is cut off from the bar stock.

Another interesting application on a Brown & Sharpe automatic screw machine is the deburring attachment shown in Fig. 12. This set-up is employed for a second operation performed on a steel locking screw, in which a cross-hole in the screw is drilled and counterbored. Cross-drilling produces a burr on the periphery of the part which cannot be tolerated. Previously, this burr was removed by an expensive third operation. Now the burr is removed by means of the attachment illustrated while the locking screw is still mounted on the automatic for the second operation.

Deburring is accomplished with a left-hand drill *A* located in the bore of collet *B* which grips the work-piece *C*. The twist drill is secured in the end of a spring-loaded shaft *D* passing through the hollow spindle of the automatic screw machine. This shaft and the drill are fed to the right to remove the burr from the locking screw by adjustable screw *E* and linkage *F*. The linkage pivots about pin *G* due to the contact of

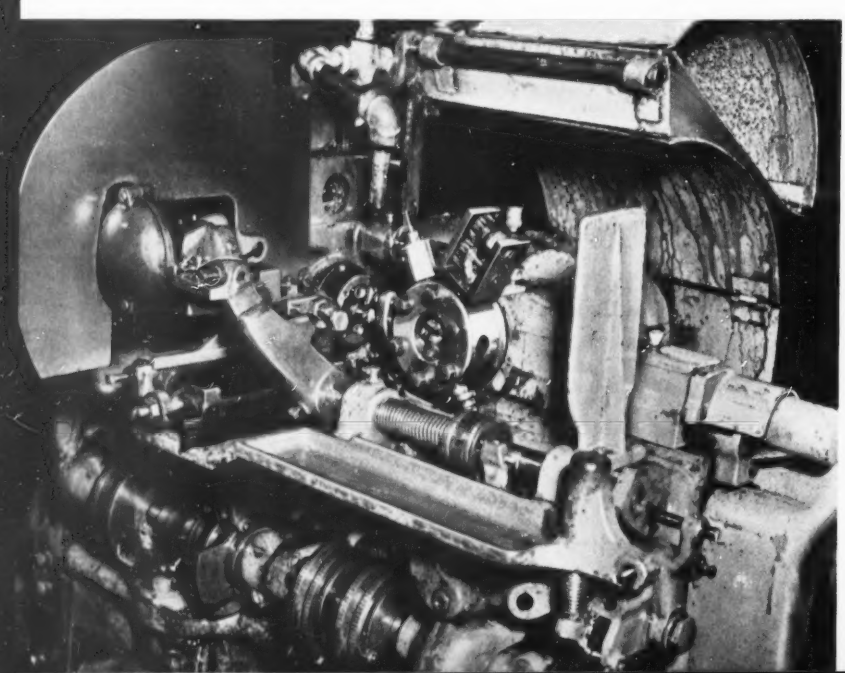


Fig. 11. Set-up on a Brown & Sharpe automatic for producing small nuts. Tool in upper position on the turret mills flats on one end of nut.

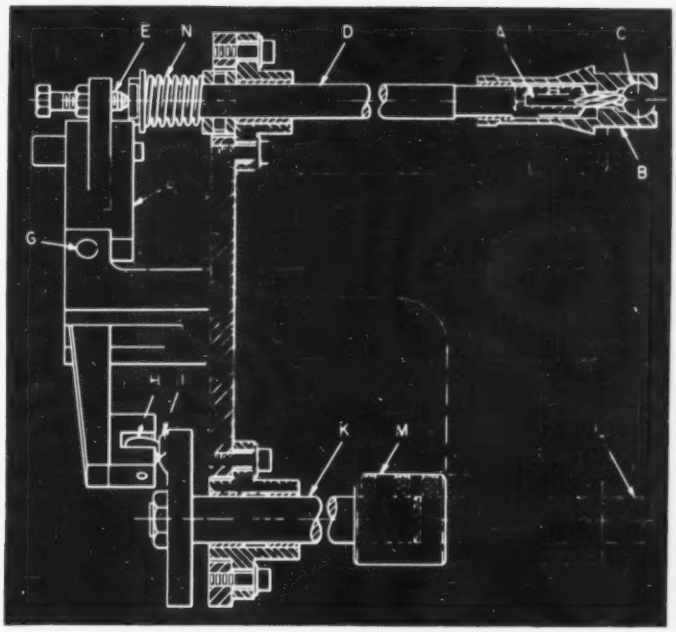


Fig. 12. Attachment for a second-operation automatic screw machine. The left-hand drill (A) removes burr from work-piece (C).

roller *H* with cam *J*. This cam is mounted on the end of a shaft *K*, which is connected to the left-hand end of camshaft *L* by means of coupling *M*. After deburring, the drill is returned to its starting position by the action of spring *N*.

A timesaving set-up for assembling and welding sleeve retainers and wire clips to speedometer cases is illustrated in Fig. 13. Open-end stock tubs containing the stamped cases are placed next to a special welding machine, and trays of sleeve retainers and wire clips are hung on the front of the machine, where they are easily accessible to the operator.

This welding machine has two stations. At the first station, the operator places three sleeve retainers on locating pins and mounts the speedometer case (in an inverted position) on the pins. Each retainer is secured to the case with two spot welds, all six welds being made simultaneously. Then the operator turns the case upside down, places it in the second station, locates a wire clip in the required position on the flange of the case, and joins the clip to the case with two spot welds.

Completed case assemblies are hung on a conveyor passing along the right-hand side of the operator. An interesting feature of this set-up is that the racked parts go directly through a conveyor type zinc-plating machine without any additional handling of the speedometer cases.

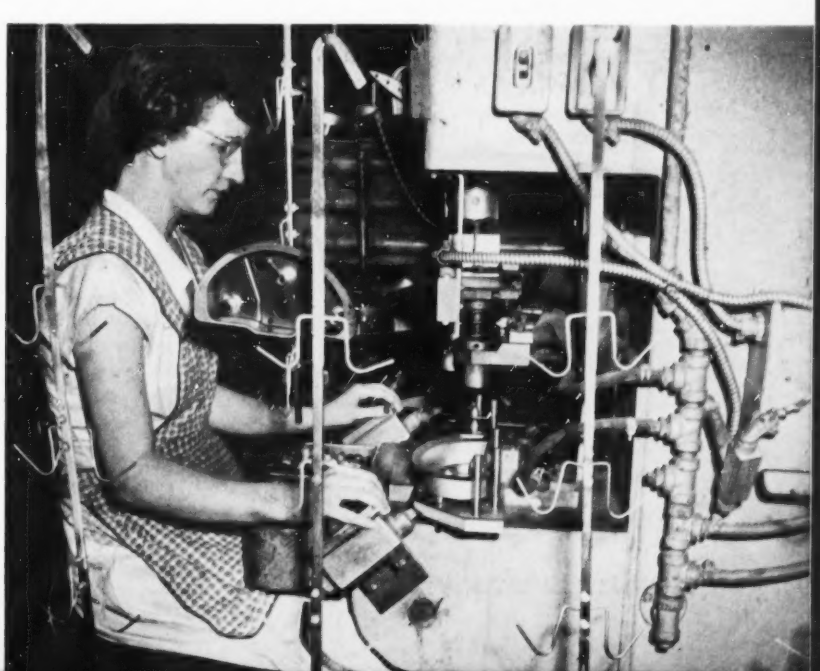


Fig. 13. Production of speedometer case assemblies has been increased by having the operator place welded assemblies on conveyor leading to plating machine.

Shell-Mold Casting of Automotive Parts

By pouring metal into thin, plastic-bonded shells, a variety of intricate castings which have a high degree of accuracy and require a minimum of cleaning and machining are being produced in volume. This revolutionary process is being used for many automotive castings at a cost that is comparable to green-sand molding.

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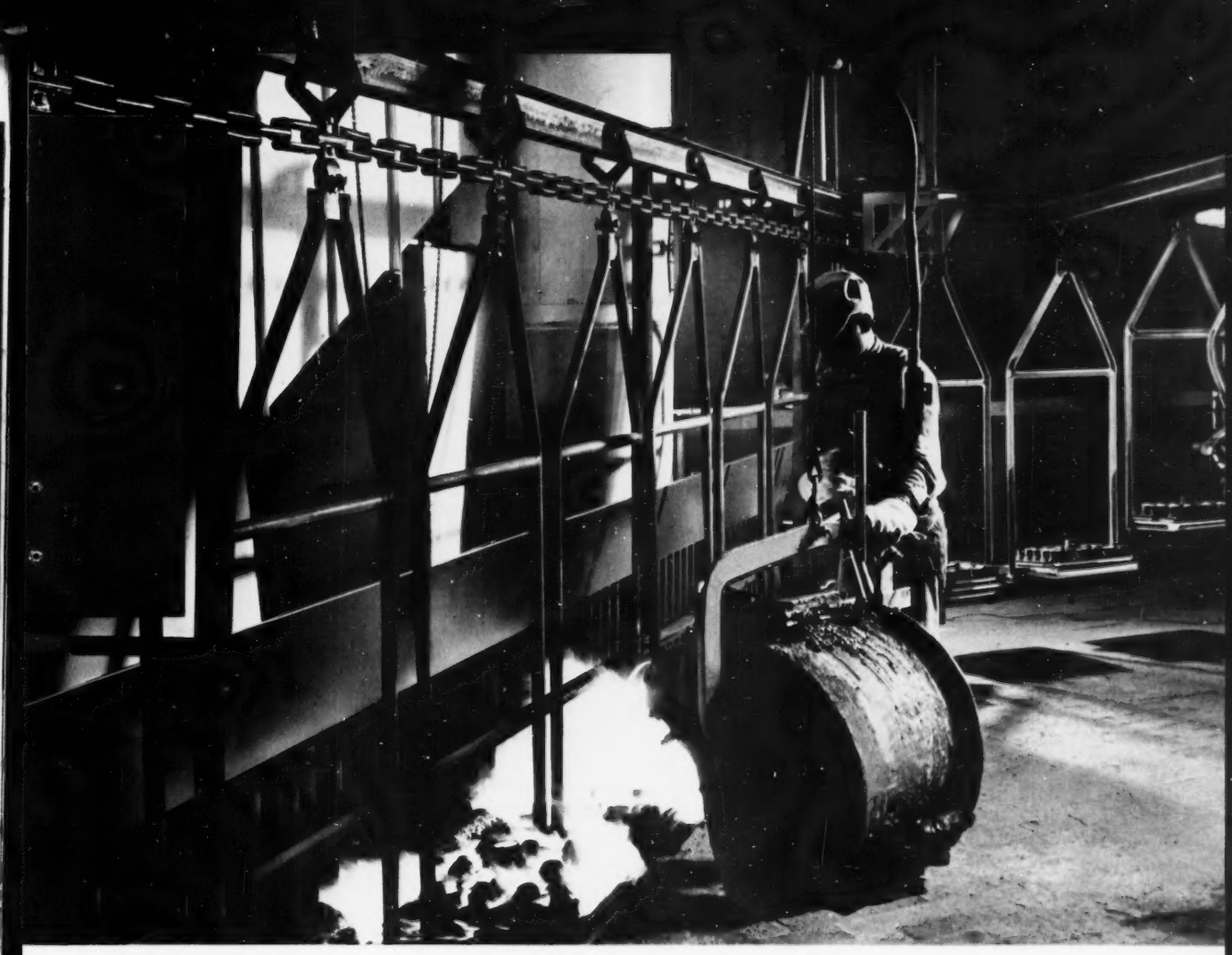
IN shell-mold casting, molten metal is poured into thin, plastic-bonded shells that produce accurate, detailed castings requiring a minimum of cleaning and machining. The process employs the thermosetting properties of powdered phenolic resins to provide a bond material for silica grains in making the thin shell molds or hollow cores.

To produce the shell mold, a mixture of fine dry sand and phenolic resin is dropped on the face of a hot metal pattern. The soft, thin crust of sand and resin is then oven-cured and stripped from the pattern. After assembling two mold halves, molten metal is poured to produce the casting. The shell mold is broken away from the casting after it has cooled.

Shell-mold casting differs from conventional green-sand casting practice, which uses clay and water as a binder, in that the molds and cores are thin shells which can be baked in less than a minute instead of hours. Relatively small volumes of sand are required (85 to 90 per cent less sand per mold). Jolting, squeezing, or ramming of the mold is eliminated.

The General Motors Research Division became interested in this process in 1947 and the G-M Central Foundry Division began work with it in 1950, setting up a department in one corner of the plant to explore its possibilities and limitations. Since very little detailed information was known or available at that time, it was necessary to start from scratch with cut-and-try methods.

Based on three years of research, experimentation, and production, it is believed that the shell process may revolutionize foundry molding techniques to the point where it will be more



economical to produce most small and some large castings by the shell-mold process rather than by conventional green-sand molding. The cost of the phenolic resins used to provide the bond material for the silica grains in the construction of the shell is the main reason for the process not being more widely used at the present time. The General Motors Research Laboratory has a continuous program to try to find either a substitute for phenolic resin or an extender material which can be blended with phenolic resin to produce a less expensive mix. Even with present resin costs, many castings can be produced at a cost comparable to green-sand molding.

Typical of the many shell-mold cast parts now being mass-produced is the gray iron valve body for automotive power steering units shown at the top in Fig. 1. Seen at the lower right is one of these valves that has been cut apart to reveal the internal grooves cast in this part by means of a shell core such as the one shown at the lower left.

Another automotive power steering part being cast in production in this way is the Arma-Steel (pearlitic malleable iron) hydraulic pump ring seen at the top in Fig. 2. Front and rear views of the shell-mold cast, gray iron pressure-plate for power steering units are shown at the bottom.

While the cost of shell-mold castings per pound is generally slightly more than and sometimes the same as conventional sand castings, subsequent cleaning and machining costs are considerably less. The reason is that parts cast in shell molds have smoother, more detailed surfaces, and can be held closer to the required dimensions. Also, machining is facilitated and tool life extended because such castings have little or no burnt-in or burnt-on sand on their surfaces.

Some of the claims that have been made regarding tolerances on shell-mold castings have been misleading. It is possible to hold to very close limits—0.001 to 0.003 inch per inch of length—on castings made under carefully controlled conditions in experimental laboratories, but the same results are very difficult to obtain

Fig. 1. Gray-iron valve body (top) for power steering unit, a sectioned valve is seen at lower right and shell core at lower left.

in high-volume production conditions. In general, most dimensions on production parts now being cast in shell molds are maintained within plus or minus 0.010 inch. Such parts vary in size up to a maximum dimension of 6 inches. It is believed that as the technique is further developed it will be possible to cast many surfaces to much closer dimensional tolerances.

An excellent example of the amount of machining that can be eliminated is illustrated in Fig. 3. The gray iron annular piston (for an automotive automatic transmission) seen at the left was cast in a shell mold and weighs 4.3 pounds, while the sand-cast piston at the right weighs 6.4 pounds. Thus, 2.1 pounds more of metal must be machined from each sand casting. The smoother, more detailed surfaces obtained on the shell-mold casting can be observed. If necessary, a surface finish of 150 micro-inches r.m.s. or less can be cast by employing finer sand and closely controlling the process.

This process is particularly advantageous for quickly and simply producing complicated molds when fins, passages, or thin sections down to about 0.100 inch must be cast. In some cases, it is practically impossible to produce certain parts in any other way without prohibitive machining costs. Such a part is the gray iron, manual control valve body—two views of which are shown at the bottom in Fig. 4—for the automatic transmission of the "Otter" amphibious, cargo-carrying military vehicle. Aluminum die-castings were unsatisfactory for this particular application. The drag shell mold for casting this part is seen at the top, and the core at the center. The plain cope with pouring gate and runners is not shown.

Physical properties of shell-mold castings are essentially the same, and their internal soundness is comparable to green-sand castings. The shell molds have practically no moisture content, thus eliminating trouble from steam generation. Dryness of the mold surfaces permits somewhat cooler pouring temperatures than employed in green-sand casting.

Gray iron, malleable iron, and ArmaSteel are being cast in shell molds. However, the process is not limited to these metals, and probably any metal now cast in sand can be produced in this way.

At Central Foundry Division, the shell molds are made from a mixture containing 6 to 7 per cent by weight of powdered phenolic resin and the balance sand, except for 1/4 to 1/2 per cent of a "liquidizer." The liquidizer is a wetting or pick-up agent employed to minimize dusting and reduce the tendency for the resin to segregate by coating the individual grains of sand for better adherence of the powdered resin. Although kerosene, fuel oil, and low-viscosity lubricating oil have been used for this purpose, a liquid phenolic resin is currently being employed.

Fig. 2. Shell-mold cast hydraulic pump ring for power steering unit is seen at top; front and rear views of pressure-plate at bottom.

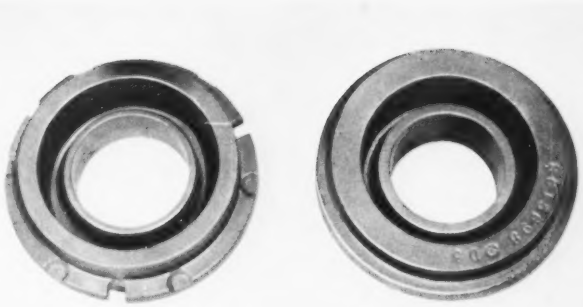


Fig. 3. Sand-cast piston at right weighs 6.4 pounds, while same shell-mold cast part (left) weighs only 4.3 pounds.

The type of sand employed for shell molds will affect the quantity of resin required and the surface finish of the casting. Less resin is required with coarser sand, but rougher surfaces are cast. When finer sand is used, smoother finishes can be cast but the shell molds are weaker with the same resin percentage. It is essential that the sand be screened and dried, as small amounts of impurities or clay may weaken the molds. The selection of the type and fineness of the sand is an economic problem based on increased cost of sand and decreased cost of resin, or vice versa. Clean bank sand of A.F.S. 105 grain fineness is being employed with good results.

A conventional type muller equipped with a dust hood is employed for blending the resin-sand mix. First, the liquidizer is added to the sand and thoroughly mixed before adding the powdered resin. Mixing is continued for about fifteen minutes to insure uniform distribution of the ingredients. However, too long or too vigorous mixing must be avoided to prevent excessive heating and possibly premature curing of the resin.

Since special equipment was not commercially available when General Motors Central Foundry Division began working with the shell process, it was necessary to design and build the shell-making machines and ovens, as well as allied equipment. Two of the completely automatic shell-making machines, which are integral with gas-fired, radiant-burner ovens, are seen in Fig. 5.

The shell-making machines consist essentially of an open-faced metal dump-box, shown in the foreground of Fig. 6, which is mounted on trunnions to permit rapid inversion. The box is kept filled with the sand-resin mix to a depth of from 10 to 12 inches. At present, the mix is carried from the muller to the mold-making machine by means of castered trucks, and hand scooped into the dump-box. However, this part of the operation will be conveyorized.

Hinged to the open top of the dump box is a pattern, seen at the upper left in Fig. 6. Although patterns have been made from steel, aluminum, and copper alloys, the ones employed at this plant are made from cast iron. Whatever the material, the patterns should have good mechanical strength and sufficient heat resistance to withstand temperatures of 450 degrees F. for extended periods and 700 degrees F. for short lengths of time. Also, the pattern material should be hard enough to resist scratching and deformation, but fairly machinable. Resistance to sticking is also an important requirement for the pattern material.

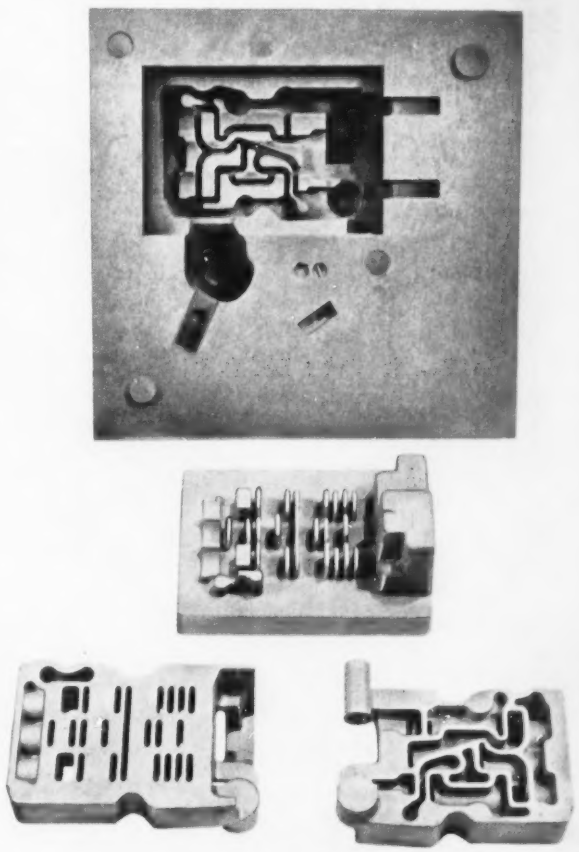


Fig. 4. Drag shell mold (top) and core (center) for casting automatic transmission control valve bodies (bottom) used in a military vehicle.

Fig. 5. On the shell-making machine seen at the left, a cured mold is about to come out of the oven, while at the right, molds are being stripped from a pattern.

The pattern plates are provided with dowels to permit accurate alignment of the shell-mold halves, and spring-loaded ejector pins to lift the molds from the pattern. Though some draft is desirable, shell molds can be ejected from patterns having little or no draft. In most cases, 1 degree of draft is ample, and 1/2 degree or less is often employed for closer dimensional accuracy. Therefore, the shell process lends itself to the production of molds having deep pockets and intricate shapes.

Standard shrink tables can, in general, be used in making the patterns, depending on the composition of the metal to be cast. For example, not all irons will shrink 1 per cent, and some ductile irons will actually expand after annealing. Thick sections of the pattern should be contoured to permit uniform distribution of heat to the surfaces of the pattern.

The patterns are heated to, and maintained at, a temperature of approximately 450 degrees F., and sprayed with a parting agent that facilitates stripping the mold from the pattern. Then the pattern is swung down onto the open top of the dump-box and secured in place with pneumatic clamps. A heat-insulating gasket is pro-

Fig. 6. Patterns for drag and cope halves of shell mold (upper left) are about to be swung down onto top of dump-box.

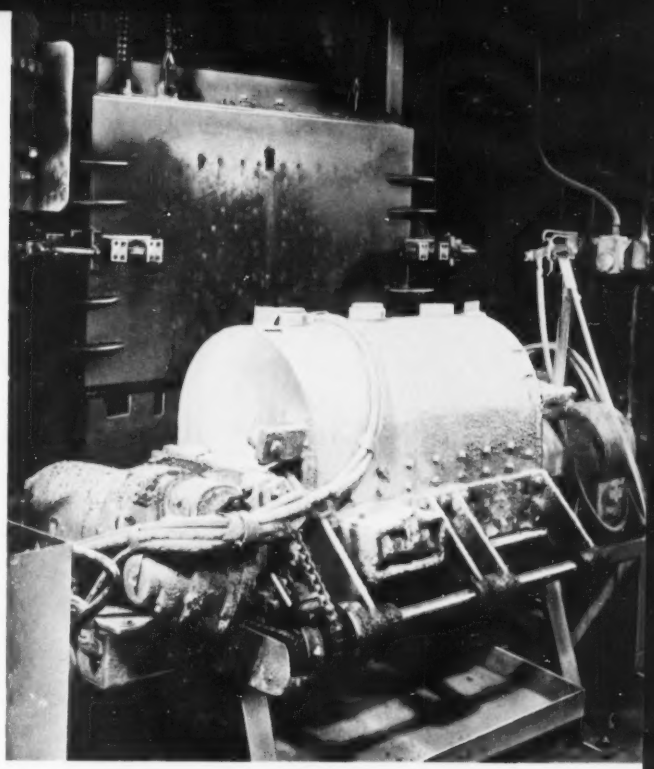


Fig. 7. Dump-box is inverted 180 degrees to drop sand-resin mix onto hot face of pattern. Time of inversion controls thickness of mold.

vided on the top edge of the dump-box to minimize fusing of the mix to the sides of the box resulting from heat being transferred from the pattern.

The box is inverted 180 degrees, as shown in Fig. 7, thus dumping the sand-resin mix onto the hot face of the pattern. Heat from the pattern causes the resin to soften and flow, thus surrounding the sand grains adjacent to the pattern and forming a thin, partially cured shell mold. This feature, in addition to curing of the mold while it is still in intimate contact with the pattern, produces a mold just as accurate as the pattern itself. The length of time that the mixture is exposed to the hot pattern determines the thickness of the shell. For most castings now being produced, the exposure time is from twenty to twenty-five seconds, resulting in shell molds from 1/4 to 5/16 inch thick.

After this pre-set time, the box is automatically returned to its upright position, the oven door lifts open, the hinged pattern with the soft sand-resin crust adhering to it is swung through an angle of 180 degrees into the oven for curing, as seen in Fig. 8, and the oven door closes. Excess sand-resin mix falls back into the bottom of the dump-box and is ready for the next cycle.

The gas-fired, radiant-burner ovens are maintained at a temperature of 1000 to 1200 degrees F., and the shell molds are cured for the minimum length of time necessary to yield a structure that will withstand subsequent handling. This curing time varies from thirty to sixty seconds, resulting in a tan colored shell mold having a hard, smooth inner surface. If this inner surface feels sandy or has a marbled appearance, it is an indication of improper sand-resin mixture or pattern temperature.

At the completion of the pre-set curing cycle, the oven door automatically rises, the pattern and molds are swung to a vertical position, and ejector-pins strip the molds from the patterns, Fig. 9. Although the back sides of the molds are

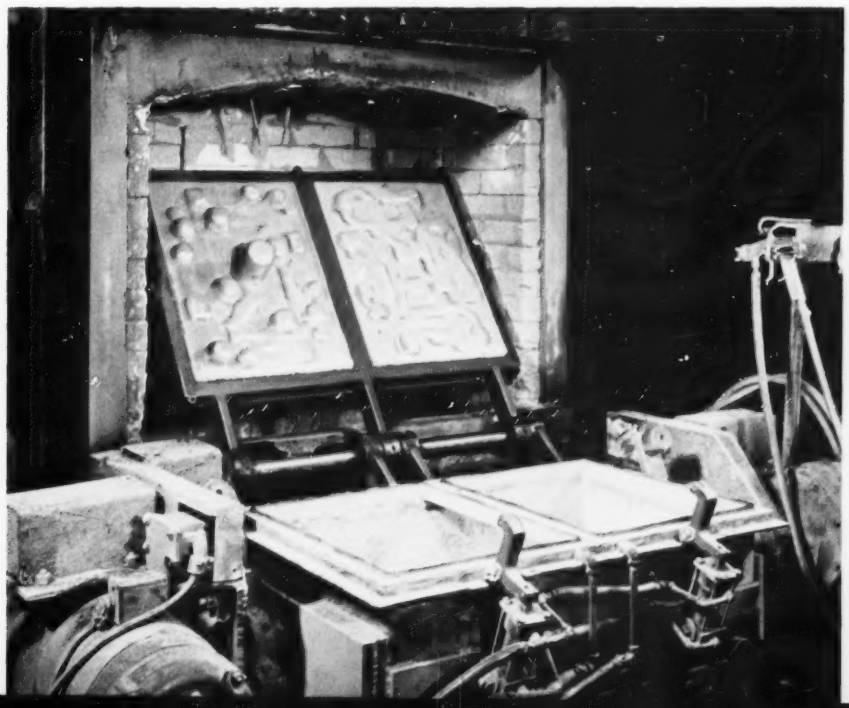


Fig. 8. Pattern with sand-resin crust adhering to it is swung into oven. Curing time in oven varies from thirty to sixty seconds.

Fig. 9. After curing, the oven door rises, the pattern and molds are swung to vertical position, and the ejector-pins strip the molds from the patterns.

rough, the important casting surfaces formed by contact with the pattern are hard and smooth. The operator places the drag half of the molds on the spring-loaded vertical pins of a gluing machine, Fig. 10, and the cores are set in place if required.

Cores are made in a similar manner to the molds, except that they are formed by blowing the sand-resin mix inside a heated, split core-box, as shown in Fig. 11. The excess mix is dumped out of the box, thus producing a hollow core. Also, cores are made from silica sand instead of the bank sand used for molds, and only 4 per cent by weight of powdered phenolic resin is required for the mix. Instead of conventional mixing, the resin is dissolved in alcohol and dripped slowly into the sand during mulling. This procedure provides a more uniform resin coating of the sand grains, decreases dusting, and increases the efficiency of the resin.

A fixture is employed to vibrate powdered thermosetting resin adhesive onto the drag molds. After knocking out the top of the pouring sprue, the cope half is placed on the drag half and the starting button on the gluing machine is depressed. This automatically moves the squeeze-head of the gluing machine into position, Fig. 12, and the two mold halves are pressed together for a pre-set time—sufficient to insure a firmly bonded, complete shell mold.

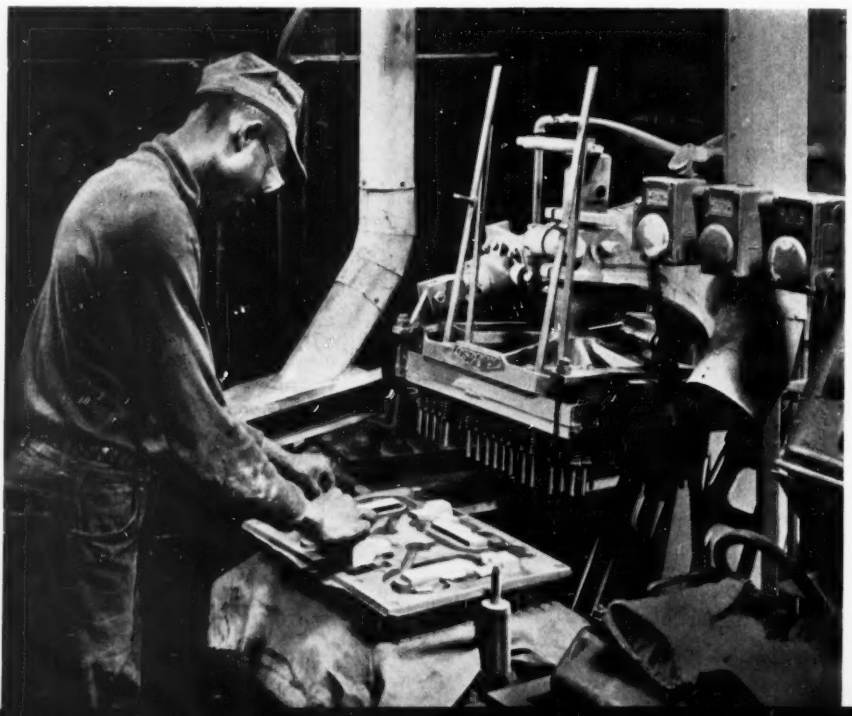


Fig. 10. Drag half of shell mold is placed on spring-loaded vertical pins of gluing machine, and shell cores are inserted.

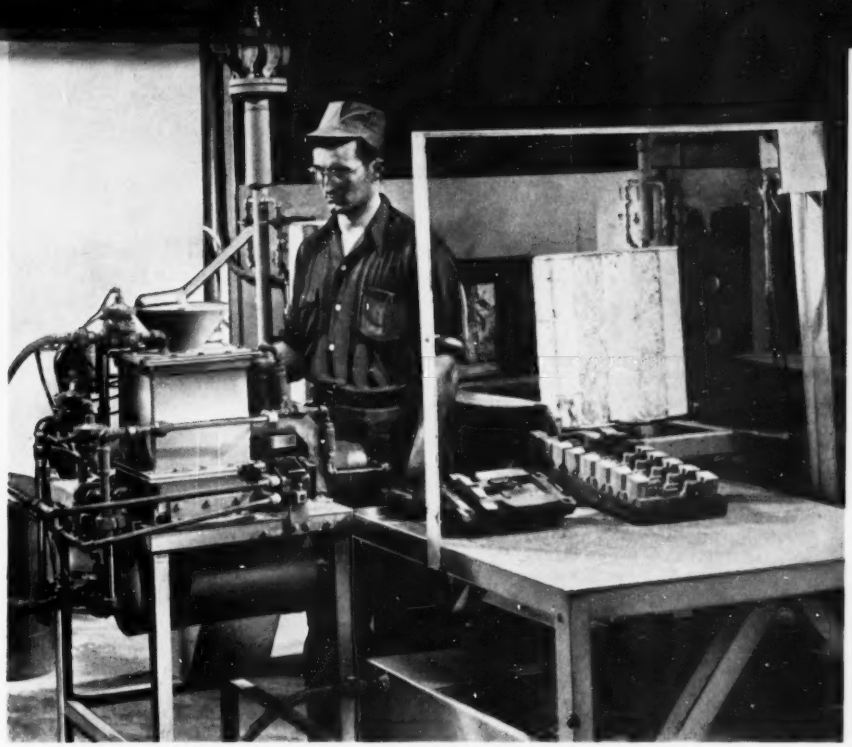


Fig. 11. Shell cores are formed by blowing sand-resin mix inside a heated, split core-box. Curing oven is seen at rear.

The finished molds are placed on a continuous pendulum type conveyor, Fig. 13, located alongside the shell-making machines. The conveyor carries the shell molds past a pouring line, seen in the heading illustration, where molten metal in 1 4-ton capacity ladles is poured into the molds. The porosity of the molds allows free escape of entrapped air and gases.

Although many users of the shell process have found it necessary to back up the molds with steel shot during pouring to withstand the pressure of the molten metal and prevent distortion of the shells, this has been found unnecessary with the size parts being cast at General Motors Central Foundry Division. The need for backing up the molds has definite disadvantages—the shot must be cooled, the loss of shot is considerable, and steel shot on the foundry floor is a safety hazard. Another major difference is that while most foundries suspend the shell molds in a vertical position during pouring, all of the castings produced at Central Foundry are poured horizontally.

After pouring, the shells remain on the continuous conveyor for a short period of cooling. On arriving at an overhead, vibrating shakeout screen, Fig. 14, a pneumatically actuated mechanism tips the conveyor plates, and the shell and castings are dumped onto the shakeout screen. Here the shells and cores are disintegrated by vibration, the sand falling through the screen and the gated castings sliding into hoppers. The sand can be reclaimed by burning out the resin. The resin will decompose and burn at temperatures over 1000 degrees F.

Typical of the gated castings produced with this process is the one shown in Fig. 15. In this set-up, twenty-six malleable iron booster bodies are cast in one shell mold. After breaking the gated castings apart and annealing them, the gates are broached from each casting. Because surfaces are already clean and smooth, minimum finishing is required.

Another advantage of the shell process is that

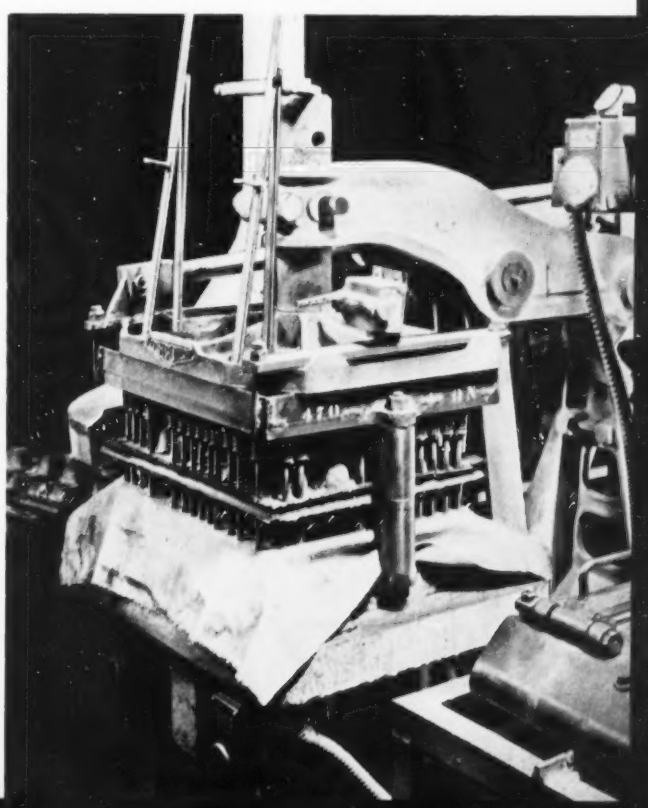


Fig. 12. With resin adhesive applied to the drag half, and the cope half assembled, the halves are pressed together for a pre-set time.

Fig. 13. Completed shell molds are placed on a continuous pendulum type conveyor (next to mold-making machines) that carries them past a pouring line.

complete mechanization of the molding operation is possible for high production runs. Also, relatively unskilled labor can be employed, and working conditions are greatly improved. Less space is required, resulting in higher mold production per square foot of floor area. Since completed shell molds can be stored indefinitely without deterioration, stocks of molds can be built up to meet future requirements for critical castings.

A limitation of the process in addition to the high cost of resin is that volume production is usually a basic requirement. Also, as with other types of casting, the design of the part must lend itself to suitable parting, gating, and heading. Pattern costs are higher than for green-sand casting, and, from the over-all cost standpoint, every part is not suitable for shell-mold casting.

The size of the casting is not necessarily a limitation. It is understood that parts weighing up to 200 pounds have been produced in this way. However, the process does lend itself particularly well to the production of smaller castings. Research on the process is continuing, and it is expected that it will be rapidly applied to more and more production parts as improved techniques are developed.

The parts shown in Fig. 16 have been shell-mold cast experimentally, and are not yet in production. The pump rotor for an automobile

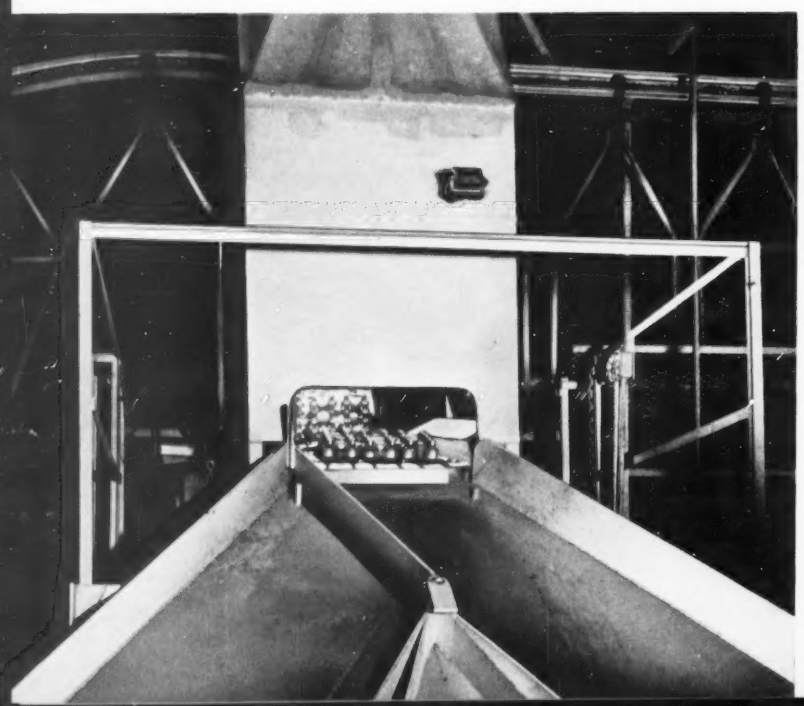


Fig. 14. Cam-actuated mechanism tips the conveyor plates, dumping the shells and cooled castings onto an overhead, vibrating shake-out screen.

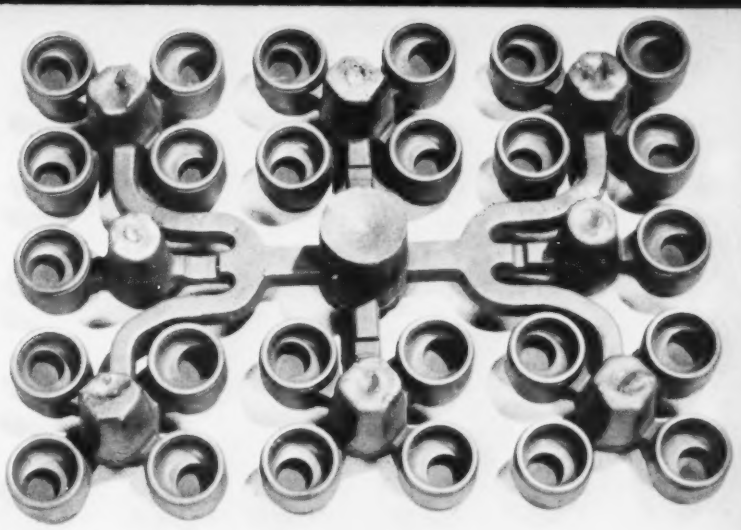


Fig. 15. Gated casting produced by the shell-mold process contains twenty-six malleable iron booster bodies. Note clean finish and smooth surfaces.

automatic transmission seen at the upper left has been cast in both gray iron and ArmaSteel. The part at the upper right is a gray iron door striker for an automobile car body. At the right center is a malleable iron automobile door hinge. A gray iron bearing sleeve for automotive differential applications is seen at the lower right, and another gray iron hydraulic pump part for automotive power steering is at the lower left. The gray iron control valve for an automobile heating system (for heating intake gases) is shown at the left center. In the middle is an ArmaSteel torus hub for an automotive automatic transmission. Many of the cast surfaces on these parts, such as the cast-in bolt holes, require no machining.

Governor bodies and bushings, Fig. 17, for an automatic transmission were formerly made of aluminum die-castings, but the steel piston-rings used in conjunction with the aluminum governor body caused excessive wear in the ring grooves. It has never been possible to cast these parts in a ferrous material because of the intricate coring involved. By making the cores of a mixture of phenolic resin and sand and using the shell-molding process, this has now become a relatively simple job to cast in gray iron; and 4500 pieces of each part are being produced daily. It has been reported that excessive wear in the ring grooves has been eliminated.

Fig. 16. (Center) Group of parts that have been cast experimentally in shell molds. Several parts are for automatic transmissions.

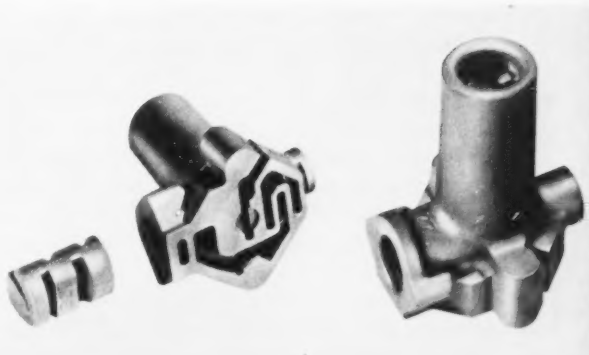


Fig. 17 (Right) Wear in the ring grooves of this gray iron governor body and bushing for an automatic transmission has been reduced by casting the parts in shell molds.

Piston Production at Ford Features Automation and Quality Control

By EDGAR ALTHOLZ
Associate Editor

PISTONS for the Ford "6" and the new Mercury "V-8" overhead valve engines are machined, plated, and graded in the Cleveland, Ohio, engine plant of the Ford Motor Co. The piston line, described in this article, exemplifies the automation and quality control found throughout the plant.

Aluminum-alloy rough castings received from the foundry weigh 1.44 pounds. About 0.020 inch of metal is allowed for removal from all surfaces to be machined. Cartons containing the pistons are spotted at the start of the machining line, where they are unpacked and loaded onto a belt conveyor. Diverters along the line guide the pistons into chutes leading to five Baird continuous six-spindle automatic chucking machines. In Fig. 1 is shown a close-up view at the chute entrance to one of these machines.

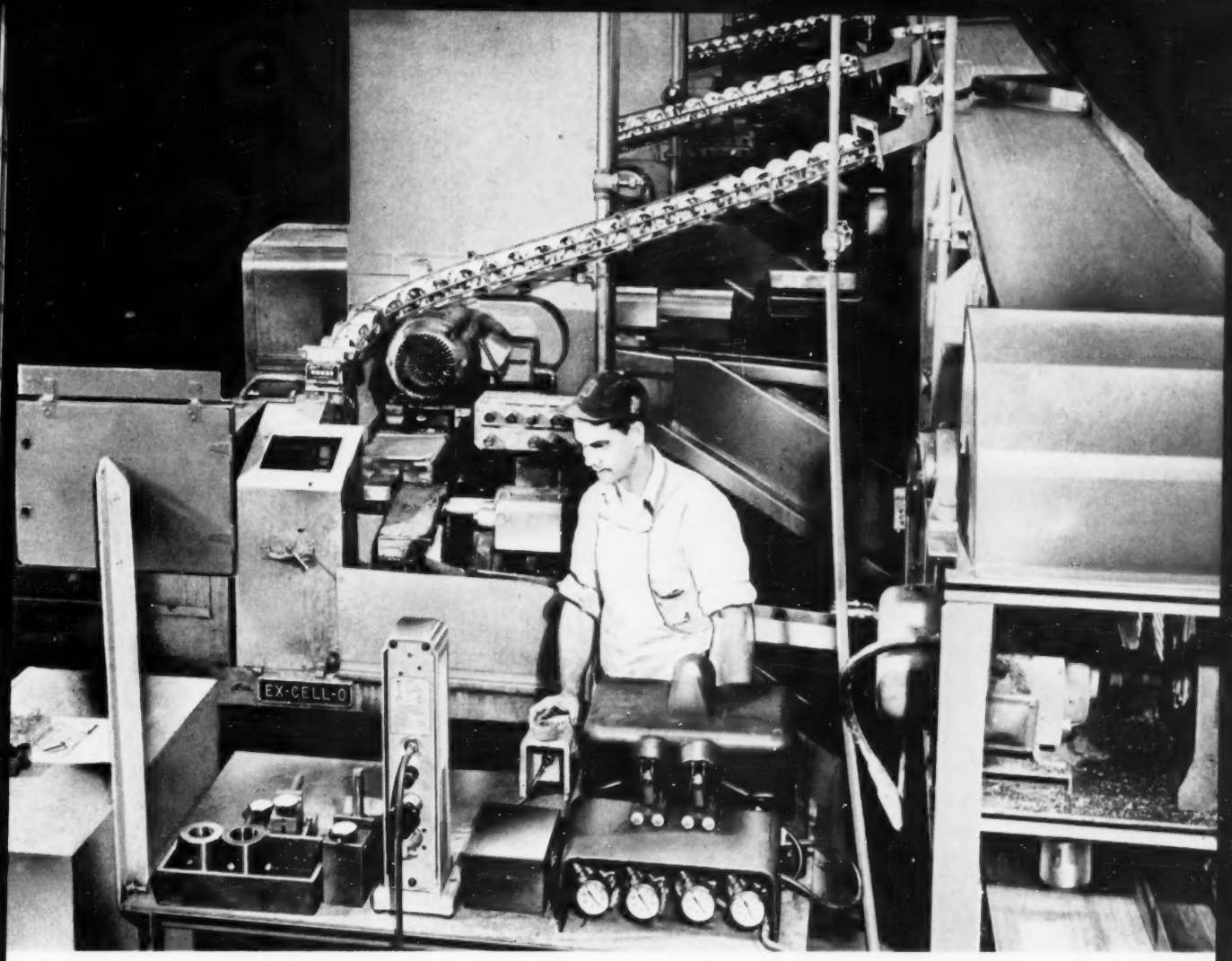
All movements, including the loading, unloading, and indexing, are completely automatic. Stations 1 and 6 are used to load and unload the work. Machining starts at Station 2, where the end of the piston skirt is faced and the diameters and widths of the three ring grooves are roughed out in a plunge cut. Rough-turning the outside diameter and rough-facing the dome are performed at Station 3. When the piston indexes to Station 4, the ring lands and skirt diameters are semi-finish-turned, and the sides of the ring grooves are given a 45-degree chamfer. Also, the dome is finish-faced, establishing the over-all length of the piston.

The final machining of the cycle, at Station 5, consists of another plunge cut to finish the ring groove diameters and widths. Unloaded at Station 6, the part is ejected onto a chute and returned to the belt conveyor. Six pistons are continuously cycling through the machine, one piston being completed for each indexing.

Chamfering the bottom of the skirt follows, the pistons being conveyed to special Hammond abrasive belt grinding machines. One of these machines is shown in Fig. 2. Because of the curve of the work surface, the flexibility of the belt makes it well suited for the job. Pistons from the belt conveyor, seen at the left in the picture, are diverted to a chute leading to a loading station.

The machine has an indexing rotary table carrying six work-spindles radially spaced 60 degrees apart. In the machine cycle, a work-spindle indexes to the loading station, where a pneumatic device thrusts the piston into the spindle fixture. Then, in sequence, the work-spindle indexes to three grinding stations.

When at a grinding station, the work-spindles commence to revolve slowly by means of gearing in the table, while a motorized abrasive belt unit running at comparatively high speed grinds the chamfer. The units are so positioned in respect



to the work that each, in turn, increases the amount of the chamfer. An unloading station, visible at the push-button panel, ejects the work pneumatically into an exit chute leading back to the belt conveyor system.

Six pistons are in work continuously, with a completed piston ejected at each indexing movement. Loading, unloading, indexing, and work-spindle rotation are entirely automatic. Should parts jam in the line, a micro switch in the exit chute stops the cycling. Pipes from each grinding unit lead to a central dust collecting vacuum system.

Provision to bring the pistons to a standard weight is made by casting them initially with two lugs at diametrically opposite points on the inside of the skirt wall. Then on a Morris balancing machine, Fig. 3, a milling cutter enters the bore to face off a predetermined amount of metal, holding the pistons to within 2 grams of the required weight.

As the pistons approach the balancing machine after the skirt-chamfering operation, they travel over a Shadowgraph (not shown). Those found to be underweight, or else too heavy for the lightening capacity of the machine, are automatically rejected. The pistons accepted continue over a second Shadowgraph, seen in the foreground of the illustration. This device registers the weight of each piston, then computes and adjusts accordingly the feed stroke of the cutter-spindle to remove the proper amount of metal.

A gripping fixture picks up the work, supporting it at an angle to present the skirt end to the cutter. This cutter is slightly smaller in diameter than the skirt bore. As the cutter revolves, it feeds up to face the lugs for a distance determined by the Shadowgraph. A spot-check on a scale adjacent to the balancing machine, which is shown being made by the worker, assures that the 2-gram weight tolerance is not exceeded.

With the pistons now at a uniform weight, they return to the belt conveyor and advance to a battery of three Cincinnati centerless grinding machines of the through-feed type, one of which is seen in Fig. 4. Here, the skirt outside diameter

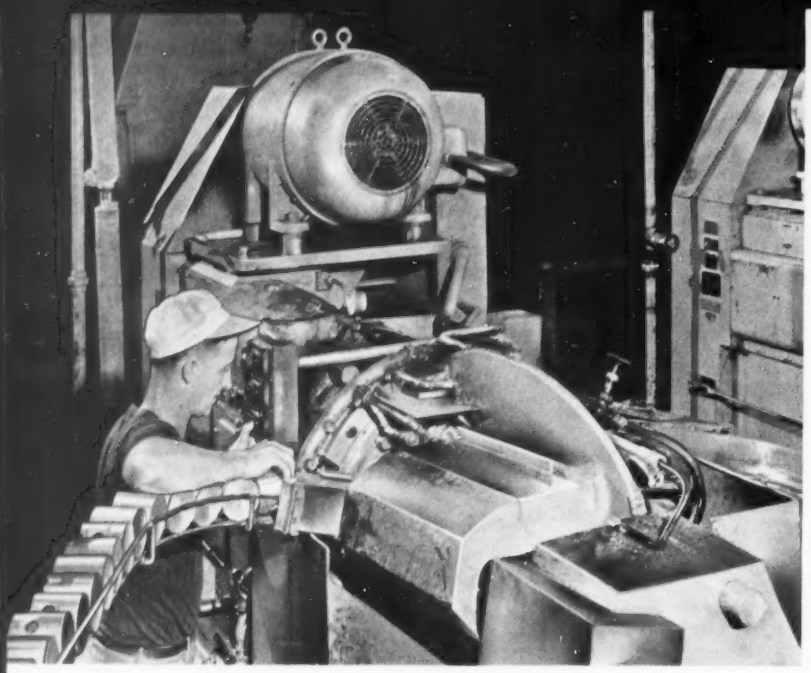


Fig. 1. In the initial operation, the skirt and ring lands are roughed, and the dome and ring grooves are roughed and finished.

and the ring lands are rapidly rough-ground, approximately 0.008 inch of stock being removed.

As in previous operations, materials handling is completely automatic—the pistons are loaded, ground, and unloaded without requiring the attention of plant personnel. Quality control consists of an occasional inspection of the work and adjustment of the grinding wheel for wear.

A row of eleven Ex-Cell-O special boring machines, seen in the heading illustration, rough and finish the wrist-pin holes. The pistons, traveling up the belt conveyor for this operation, rest on their domes. When diverted to the boring machine, the pistons move through a turning gate. Flipped sideways they roll down a chute. At the lower end of the chute, another turning gate aligns the piston with the boring-bar. Next, the piston is transferred to the machining position, hydraulically clamped, rough- and finish-bored, unclamped, and ejected.

The pin-hole diameter is held to a tolerance of 0.0003 inch. The worker in the illustration can be seen checking this dimension on one of the Sheffield "Precisionaire" gages installed between every two machines. Hole alignment and squareness to the piston axis are also checked here.

The ring land diameter, which up to this point has been the same as that of the skirt, is now reduced an additional 0.025 inch. This operation is performed on three Cincinnati centerless grinding machines of the in-feed type, such as the one shown in Fig. 5. In each cycle, six pistons are automatically loaded from the chutes of the machines, simultaneously ground, then delivered to an exit chute leading back to the conveyor system belt.

Next in the order of piston-line operations is the chamfering of the outer ends of the wrist-pin holes and the milling of the lock-ring grooves in the walls of the holes. Special five-station Baird machines do the job. A close-up view of one of them is shown in Fig. 6. Machining the two wrist-pin holes of each piston is done sequentially at Stations 3 and 5, the station between serving to rotate the piston 180 degrees on its axis.

For machining, the pistons are held on their sides, with the center line of the wrist-pin holes in a vertical plane. Since the diameters of the holes are already finished, they are used to locate the pistons accurately beneath the spindle of the machine. While the upper hole is being chamfered and milled, the lower hole engages a boss in the work fixture body.

Cycling is as follows: Stations

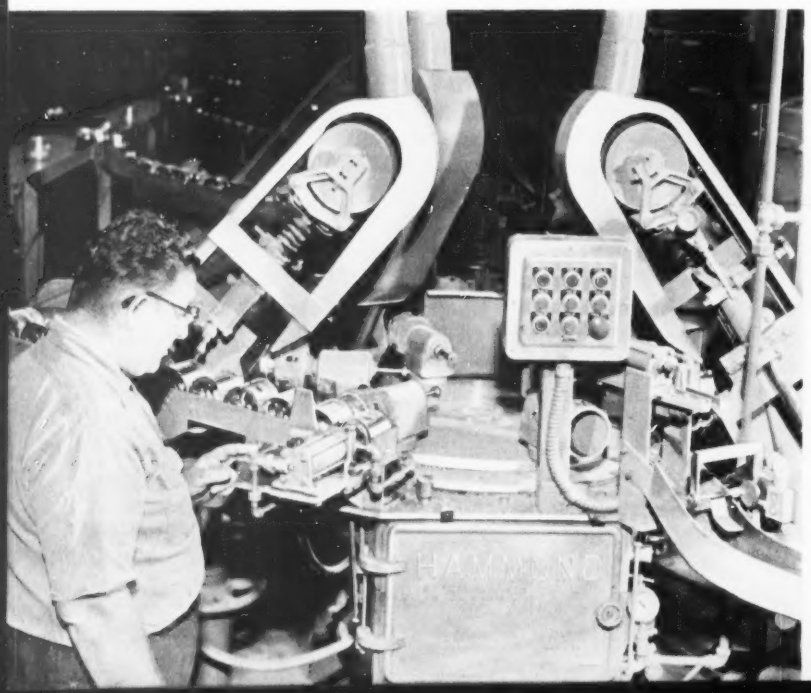


Fig. 2. As the pistons rotate, the coated abrasive belts are able to flex to maintain contact with the contour of skirt end.

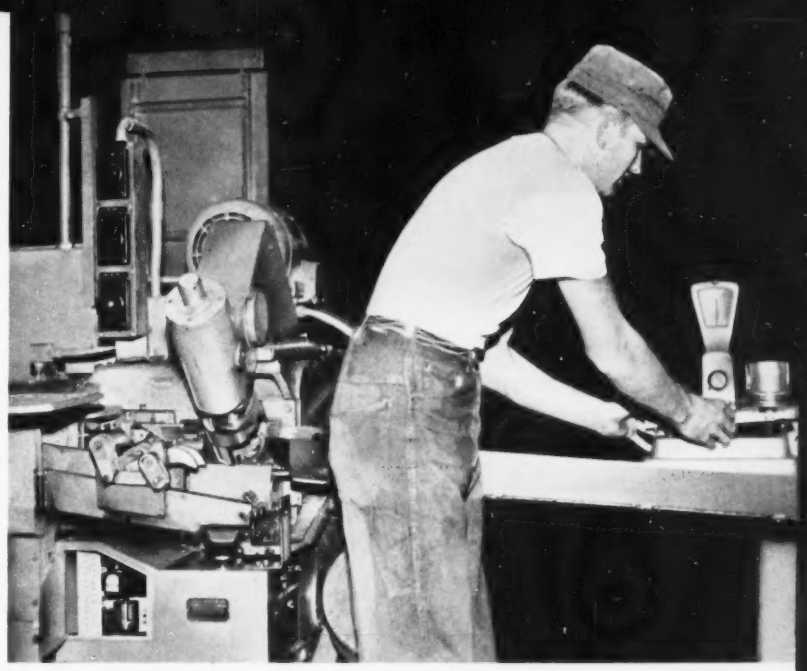


Fig. 3. The worker spot-checks a piston after balancing. Pistons must be within 2 grams of the nominal weight.

1 and 2 locate the pistons. With a piston in position at Station 3, the table of the machine is raised in a rapid approach stroke until the chamfering and milling cutters are at their respective points of entry in the top wrist-pin hole. As the machine spindle revolves, it moves laterally a short distance to sink the cutters to the required depth.

Next, the work-holder, constructed to pivot around the center line of the holes, executes a quick movement through 360 degrees. The spindle then reverses its lateral movement, the table is lowered, and the piston is transferred to Station 4. At this station, the piston rotates 180 degrees on its axis to interchange the relative positions of the two wrist-pin holes. Upon transfer to Station 5, the chamfering and milling procedure at Station 3 is repeated for the second hole. Three different pistons simultaneously occupy the three stations, thus producing a completed piston in each machining cycle.

To impart an elliptical cross-section to the skirt and ring lands (so that at operating temperatures the pistons are round in the engine cylinders) cam grinding follows. This is an infeed operation, performed on a battery of Cincinnati centerless grinding machines, Fig. 7. During each revolution of the work, a cam varies the center distance between the piston and the grinding wheel. A mandrel slipped through the wrist-pin holes is nested in the work fixture, controlling the location of the eccentricity in the piston wall.

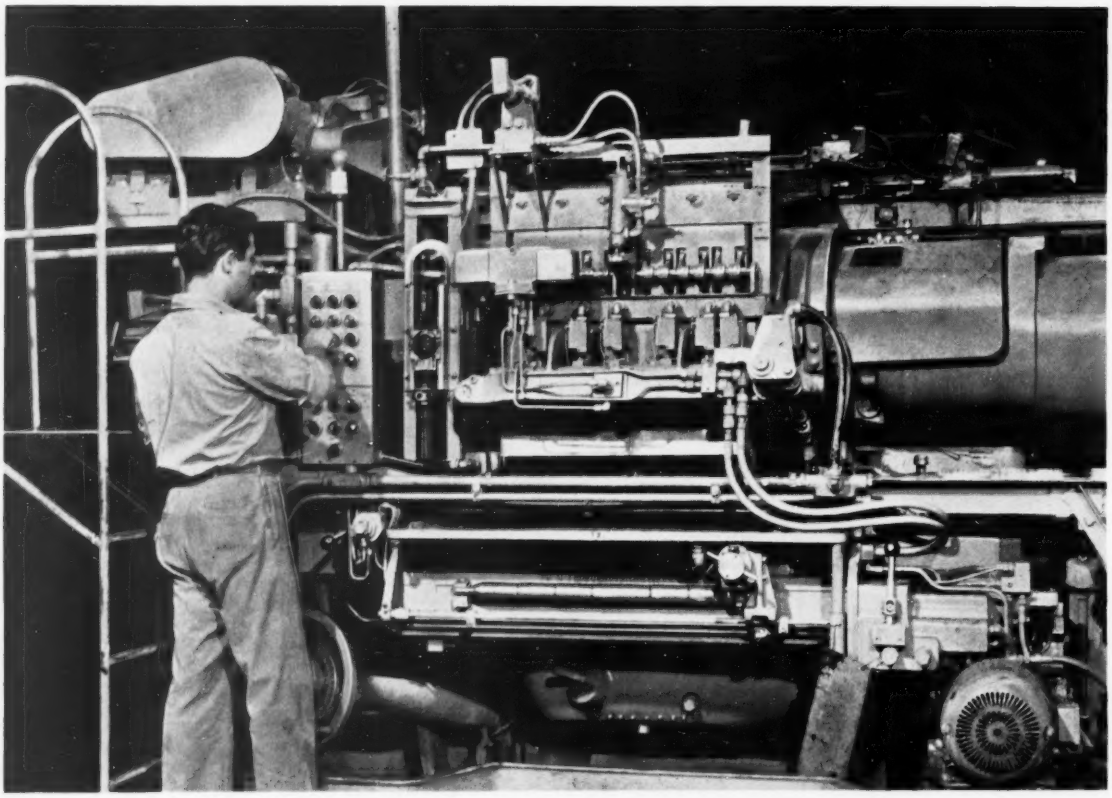
The 0.025-inch difference already established between the skirt and land diameters is maintained by the step contour of the periphery of the grinding wheel. Also, the wheel is dressed so as to taper the skirt slightly from its bottom to the ring lands, in order to reduce the amount of friction in the engine cylinder.

For cam grinding, the pistons are worked in batches that vary 0.0003 inch in diameter. The reason for this is to permit a close selective fit with the engine cylinders.

With all machining operations now completed, the pistons are loaded onto conveying racks (seen behind the cam grinding machine) and start their journey to a tin-plating tank. As an initial step, the racks pass through a cleaning oil bath. A hot-water rinse, a dip in an etching compound, and a cold-water rinse follow.

After a neutralizing nitric acid bath and a second cold-water rinse, the pistons, still on the racks, are immersed in a sodium stannate tin-plating tank, as illustrated in Fig. 8. (The plating serves the purpose of sealing the porous

Fig. 4. The initial grinding of the skirt and ring land diameters is performed by this centerless through-feed machine.



cast-iron surface of the cylinder walls during the "break-in" of the engine.)

Leaving the tank, the pistons receive final cold- and hot-water rinses, and are removed from the racks. They are next placed on a belt conveyor where they advance to an inspecting and grading station, seen in Fig. 9.

Here, a special Sheffield air-gage set-up permits a simultaneous reading of skirt and wrist-pin hole diameters. Pistons are placed in a table fixture connected by air lines to the gage shown on the bench. In the gage, floats move up or down in the air columns which are calibrated over the tolerance range so that the diameters being checked are immediately read to 0.0001-inch accuracy by the inspector.

Fig. 5. (Above) In-feeding reduces the ring land diameter below that of the skirt diameter in this operation.

Fig. 6 (Left) After chamfering and milling one wrist-pin hole, an intermediate station automatically rotates the piston 180 degrees to complete the other wrist-pin hole.

Fig. 7. The piston acquires its elliptical shape in this final machining operation.

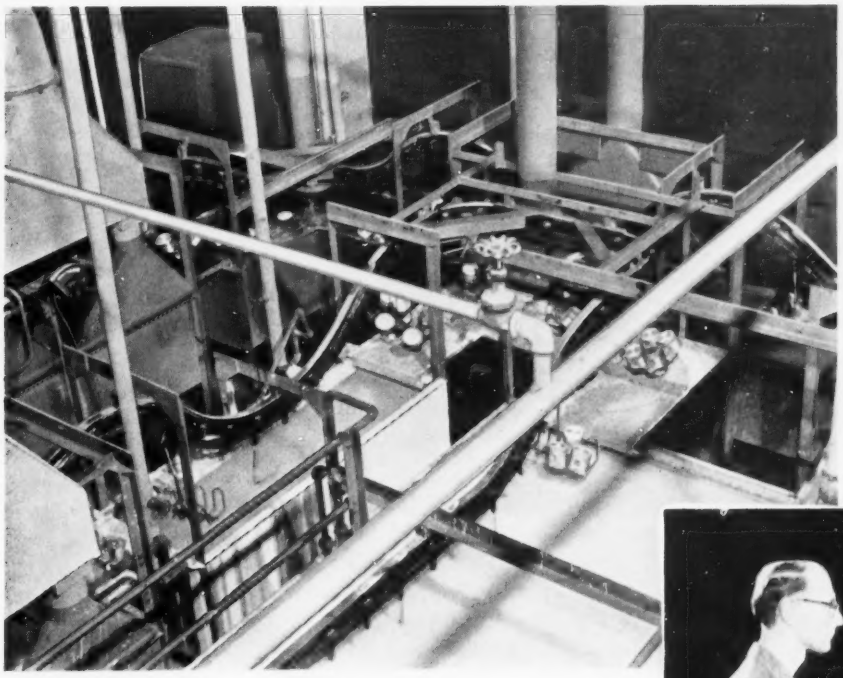
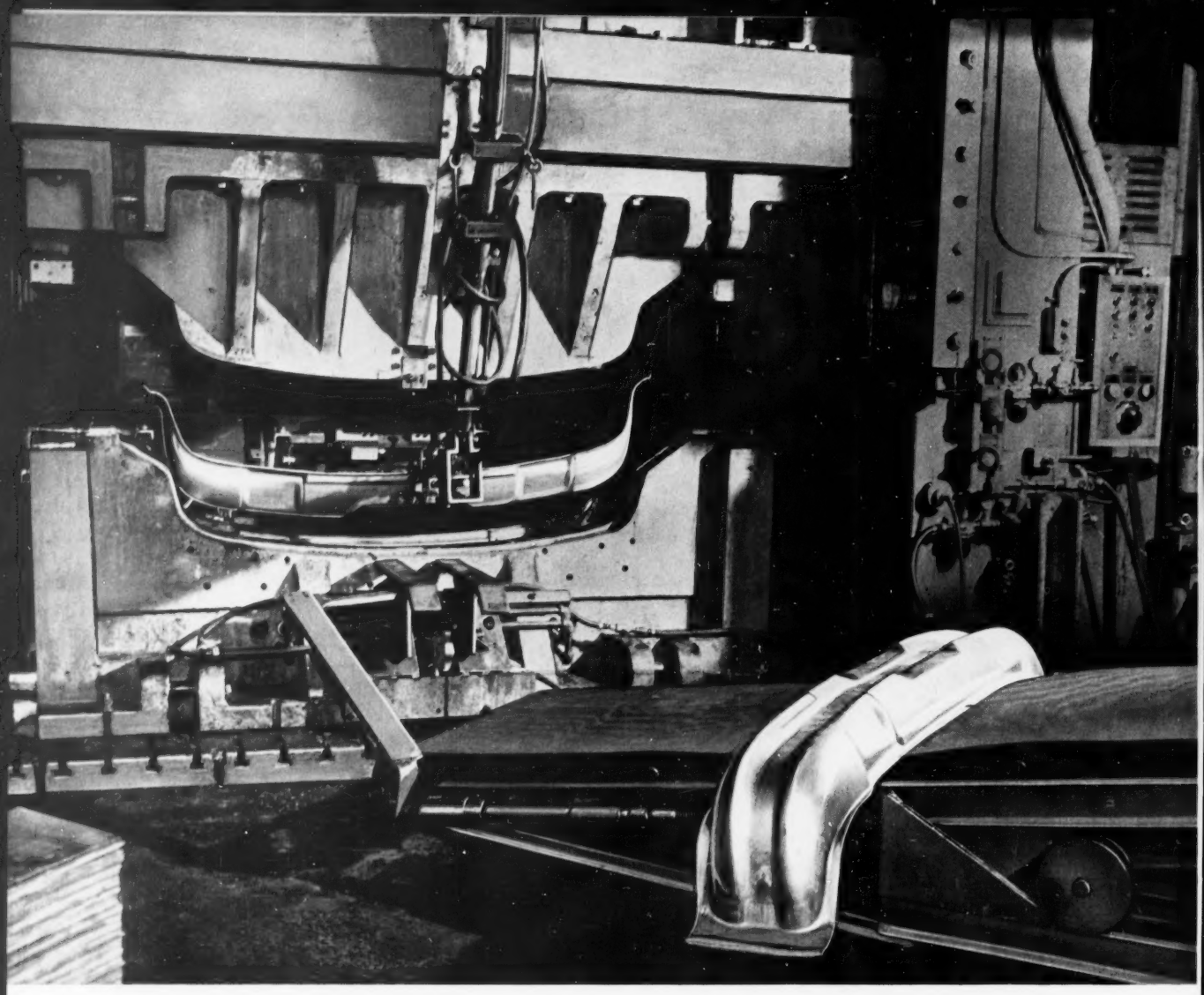


Fig. 8. (Left) Without being removed from the conveyor racks, the pistons go through the complete plating cycle.

For selective assembly of pistons and cylinders, there are eight grades; and for selective assembly of wrist-pins and pistons, there are three grades. Thus according to the combination of skirt diameter and wrist-pin diameter, a piston may be in one of twenty-four grades. The inspector grades the piston by marking its dome numerically—Nos. 1 to 8—in one of three colors.

Fig. 9. At the end of the line, the pistons are graded for selective assembly with engine cylinders and wrist-pins.



By CHARLES H. WICK
Associate Editor

Mechanisms for automatically loading, unloading, and transferring hoods, bumpers, and other large stampings have increased productivity and greatly improved safety conditions

AUTOMATION — the automatic handling of work-pieces between progressive operations—is being widely applied at the Oldsmobile Division of General Motors Corporation, Lansing, Mich. Particularly impressive results have been obtained from this program in the handling of hood panels, bumper bars, and other large stampings. Means have been provided for automatically loading, unloading, and transferring such parts, the result being substantial increases in production and greatly improved safety conditions.

Hood panels for all 1953 Oldsmobiles are blanked from S A E 1008 or 1010 deep-drawing, cold-rolled steel coil stock, 0.045 inch thick. The blanks are 84 1/4 inches long by 75 3/4 inches wide, and weigh approximately 68 pounds each. Because of their size and weight, two men are required to handle each blank; the benefits to be derived from automation are obvious.

Automation Increases Production of Stampings at Oldsmobile

Blanking is performed on a Verson 300-ton, single-action, eccentric press using coil stock. The blanks are rolled on a McKay leveler and manually loaded into the draw die mounted on the Toledo 450-ton, double-action toggle press shown in Fig. 1. Drawing compound is manually applied to the surfaces of the flat blank with brushes. As the press rises, the drawn hood panel is automatically lifted up in the die by means of ejector-pins.

Then a Sahlin "Iron Hand" mounted on the rear of the press frame, as seen in Fig. 2, automatically unloads the panel and drops it into a cradle. The jaws of this robot unloader swing into the die area as soon as the press ram has moved upward far enough to permit removal of the work, firmly grips the flanged edge of the stamping, and swings it out of the press. As soon as the hood panel has dropped into the cradle, the mechanism components return to their original positions, ready to repeat their cycle after the next stroke of the press.

The self-contained "Iron Hand" is electrically controlled and actuated by compressed air. When its jaws fail to withdraw from the die area for any reason, the press ram is automatically stopped by a safety limit switch.

Located between the draw press and a Bliss 345-ton trim press is an automatic handling mechanism, shown diagrammatically in Fig. 3. The mechanism consists of two units—a turnover unit seen at the right and a combination transfer and loading unit at the left. Both units are keyed to the dies, but are mounted on wheels so that they can be quickly removed in case of mechanical difficulties. Also, air and electrical requirements are obtained from plug type connections to speed disassembly if necessary. With this arrangement, the automatic handling mechanism can be disconnected and removed in twenty minutes or less and production continued manually.

When the "Iron Hand" *A* drops the hood panel (shown in color) into cradle *B*, the panel contacts limit switch *C*. This switch energizes a solenoid which actuates the air-powered cylinder *D* (in the inset), thus lowering the hood stop-arm *E* to a horizontal position, as indicated by broken lines.

As the hood stop-arm reaches its horizontal position, it strikes limit switch *F*, energizing another solenoid to actuate cylinder *G* and raise lifter arm *H*. Thus, the hood panel is turned over and dropped on the sliding cart *J*, as seen in Fig. 4. In its raised position, the lifter arm contacts limit switch *K* (Fig. 3), which reverses the action of cylinder *G* to return the lifter arm to its starting position, ready for the next hood panel.

When the hood panel falls on the carriage of the sliding cart, it strikes limit switch *L*, energizing a relay and solenoid to actuate cylinder *M* and move cart *J* to the left. The cart contacts limit switch *N*, thus actuating cylinder *O* and lifting arm *P* to push the panel into the trim die Fig. 5. Simultaneously, stop-arm *E* (Fig. 3) is raised to its starting position to allow another

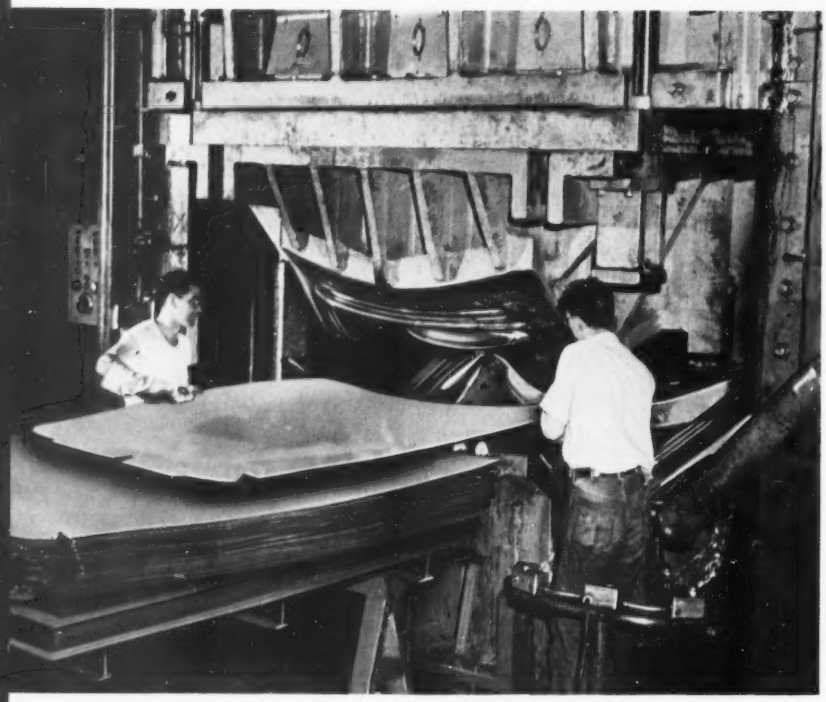


Fig. 1. Hood panel blanks—84 1/4 inches long by 75 3/4 inches wide—are manually loaded into draw die on 450-ton, double-action draw press.

hood to be dropped into the cradle. At the top of its stroke, pusher arm *P* strikes limit switch *Q*, which reverses the action of cylinders *O* and *M*, thus lowering the arm to its original horizontal position and returning the cart to the right.

Additional limit switches and relays are provided, and the units are electrically interlocked to prevent tripping either the draw or trim press until the panels are properly positioned in the dies. Pusher arm *P* must be down for the cart to move to the left. These and other safety precautions insure smooth operation and prevent doubling up of hood panels in the dies, which might cause die breakage. However, manual controls are provided on each unit to prevent interruptions in production in case the automatic controls fail.

When the hood panel is properly positioned in the trim die, as shown diagrammatically in Fig. 6, it depresses limit switch *A*. A bracket *C* on the lifter *B* must contact limit switch *D* before the trim press can be operated. Switches *E*, *F*, and *G* are inoperative on the down stroke of the press ram. However, when the press ram rises after trimming the panel and punching ornament holes, it strikes switch *G*, actuating two cylinder-operated kickers (not shown) that throw the trimmed scrap from both sides of the press. As the ram continues rising and strikes switch *F*, cylinder *H* is actuated to raise lifter *B* and the hood panel. Bracket *C* on the lifter strikes switch *J*, actuating cylinder *K* to push the trimmed hood panel out of the die.

At the end of its stroke, pusher *L* contacts

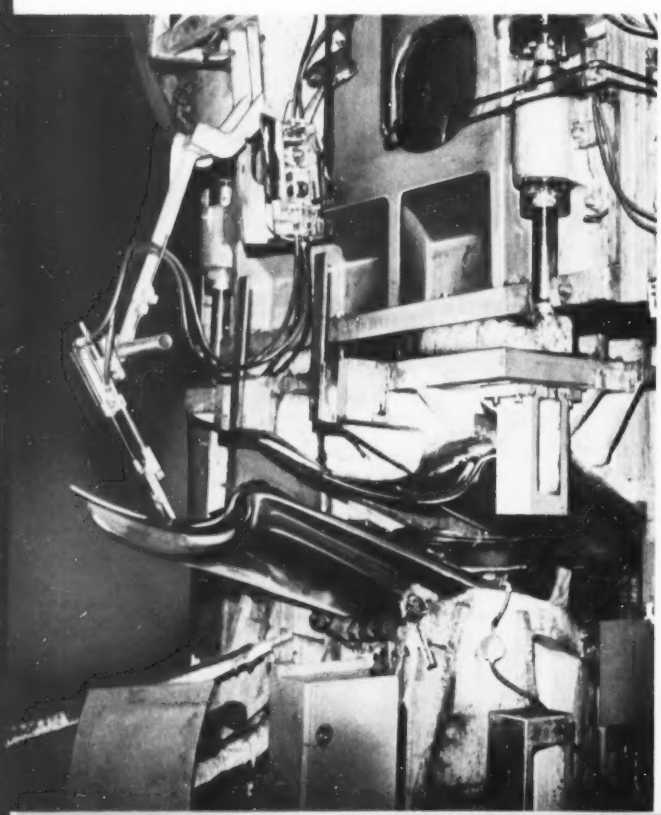


Fig. 2. Hood is automatically unloaded from draw die and dropped into cradle by means of electrically controlled, air-operated "Iron Hand."

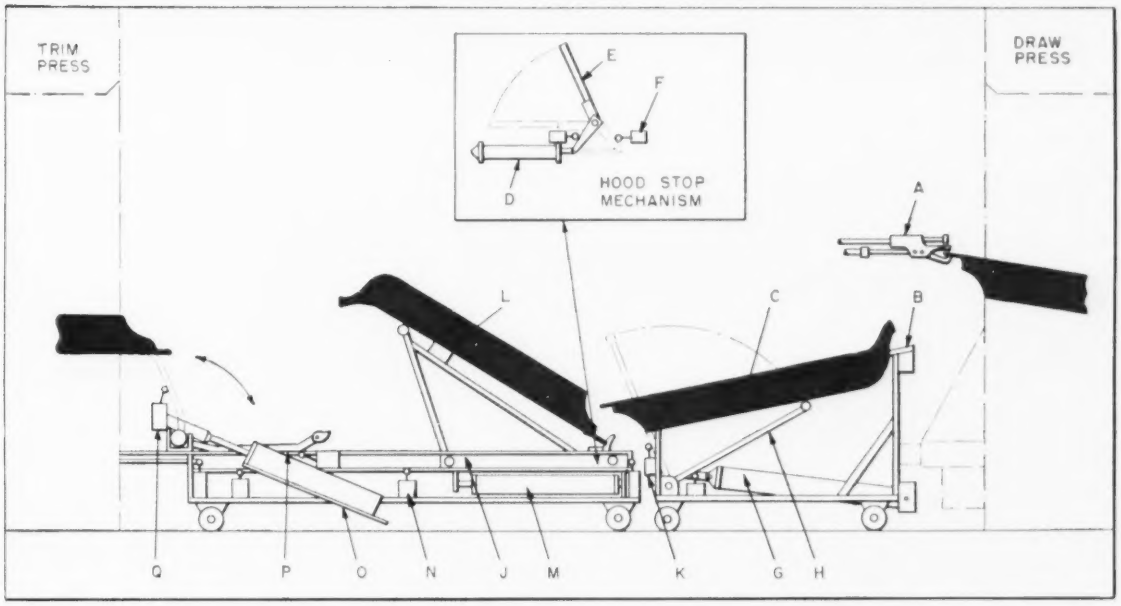


Fig. 3. Diagrammatic view of automatic unloading, transferring, and loading mechanism between the draw press (right) and the trim press (left). Hoods are shown in color.

switch *M* which reverses the action of cylinder *H* and lowers lifter *B*. The bracket on this lifter strikes switch *D*, thus reversing cylinder *K* and returning the pusher to the right.

The automatically unloaded hood panel rests on switch *N*, which trips the starter of a motor driving a double-chain transfer conveyor provided with dogs. This conveyor pulls the panel toward the flange press seen at the left. When the conveyor has completed the required travel, stop-cam *O* rides on switch *P*, the motor is stopped, and a brake is set. The hood panel strikes switch *Q*, actuating cylinder *R* and causing arm *S* to lift the front end of the panel off the conveyor.

At the end of its stroke, arm *S* contacts switch *T*, thus actuating cylinder *U* and swinging arms *V* to push the panel into the flange die, Fig. 7, mounted in a Bliss 345-ton press. Pusher arm *V* (Fig. 6), strikes switch *W* to reverse the action of cylinders *R* and *U*, and return arms *S* and *V* to their starting positions.

As was the case with the automatic unloading, transfer, and loading units between the draw and trim presses, additional limit switches and relays are provided as safety precautions. For example, the pusher in the trim die operates only if the chain conveyor is in the correct position and there is no panel resting on switch *N*. Also, arms *S* and *V* must be in their starting positions resting on switches *X* and *Y*, respectively. These arms cannot be operated if there is a panel in the flange press.

Fig. 4. Drawn hood panel is automatically turned over and dropped on a sliding cart by an arm pivoted by air-powered, oil-regulated cylinder.

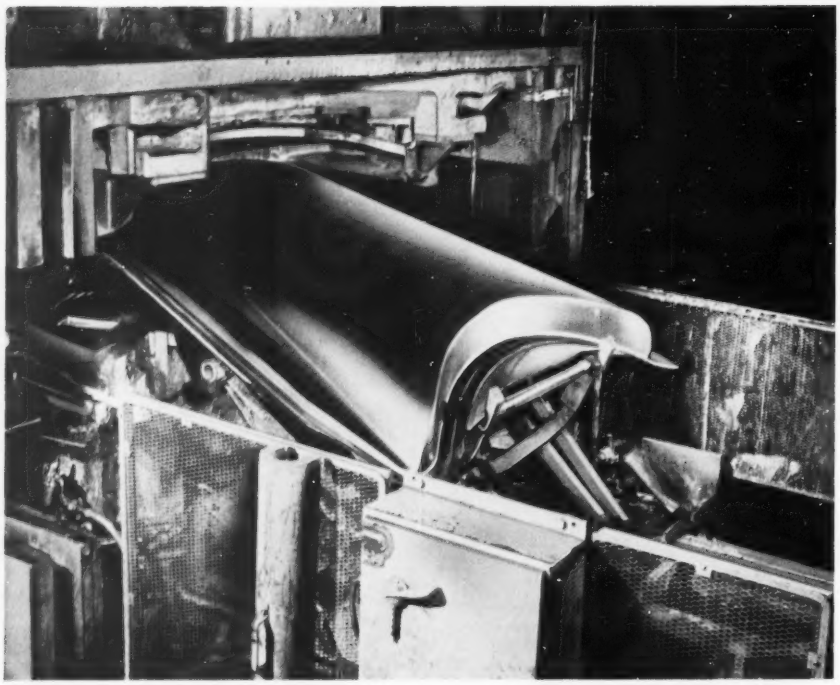
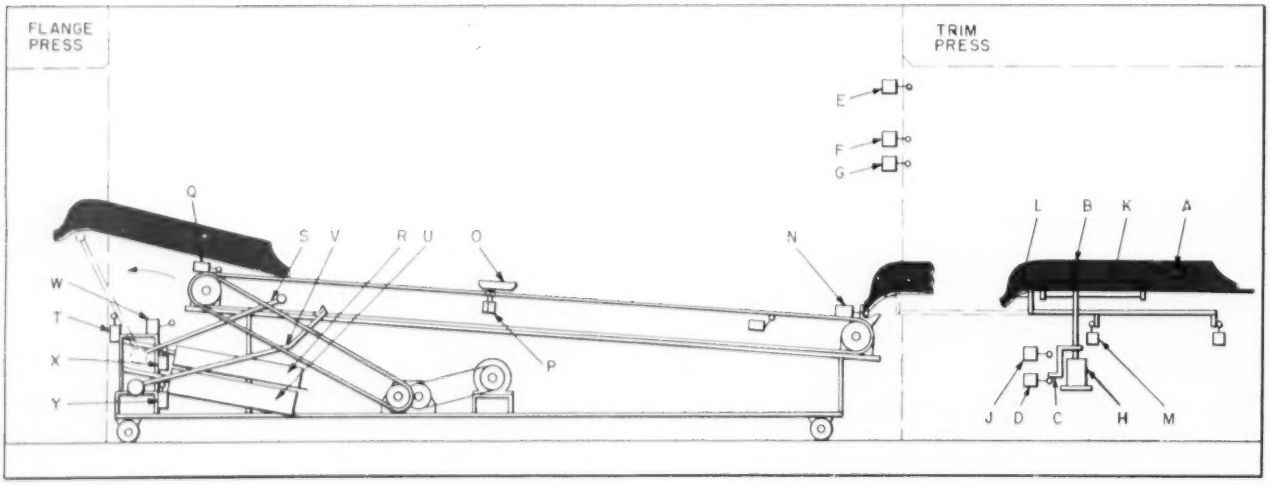


Fig. 5. The panel is here shown being automatically loaded into a flange die by pusher arm. Press cannot operate until arm is retracted.

While the hood panel is being raised and pushed into the flange die, a stop-arm—*A* in Fig. 8—is automatically swung down into position to limit the forward travel of the panel. As the panel (seen in color) positions itself in the die, it contacts switch *B*, thus returning arm *A* to its upper position. The arm must be in contact with switch *C* before the flange press can be operated.

As the press ram rises after forming the side and end flanges straight down and cam flanging the front end, it strikes switch *D*, which actuates cylinder *E* and pushes the panel out of the press, Fig. 9. When the pusher *F* (Fig. 8) strikes switch *G*, the action of the cylinder is reversed and the pusher is returned to the right. The ejected panel contacts switch *H* and actuates cylinder *J*. This cylinder drives a chain *K*, which pulls carriage *L* and the hood to the left. At the end of its stroke, the carriage strikes switch *M*, thus reversing the action of cylinder *J* to return the carriage to its starting position. Operators

Fig. 6. A double-chain conveyor is employed to transfer the trimmed hood panels (seen in color) to the flange press. Switch (N) actuates the conveyor driving motor.



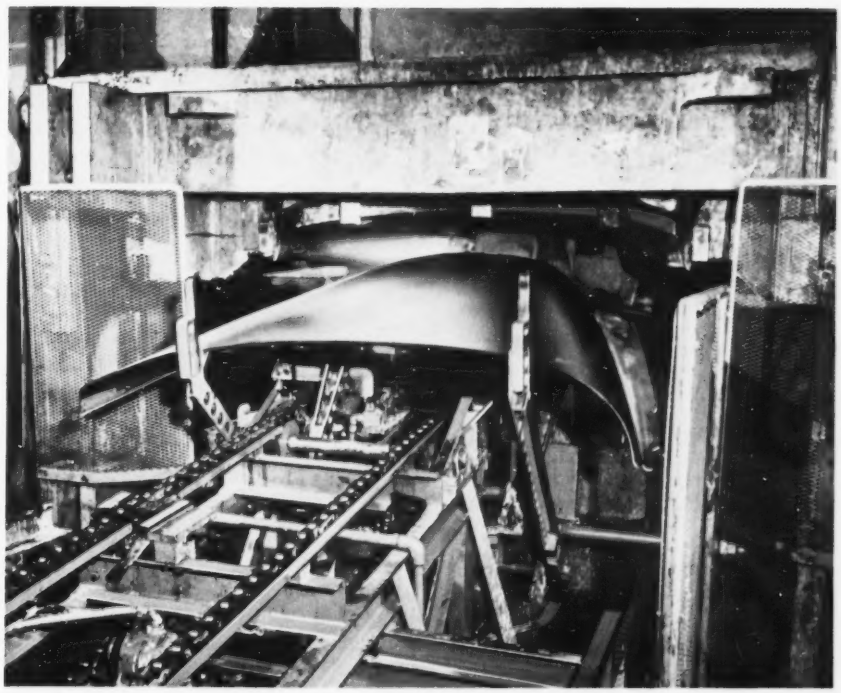


Fig. 7. Trimmed hood panel is automatically loaded into flange die by a pusher that is operated by an air-powerd, oil-regulated cylinder.

manually remove the flanged hood panels at this point.

All of the lifting and pushing arms, as well as the sliding cart and carriage of this automatic loading, unloading, and transfer mechanism, operate on anti-friction bearings. The majority of the cylinders are Logan Air-Draulic units having an air piston and a hydraulic piston on a single rod. Thrust or pull is obtained by means of the air cylinder. Two chambers in the hydraulic cylinder are connected externally in a self-contained circuit with an adjustable speed control valve.

With this set-up, it is possible to draw, trim, and flange an average of 142 hood panels per hour, with only four operators—two loading the draw press and two unloading the flanged panels. After more than a year of operation, there have been no appreciable delays in production due to failure of the automatic work-handling units.

Bumpers Drawn Two at a Time and Automatically Unloaded

Primary rear bumper bars for the 1953 Oldsmobile Series 88 and 98 automobiles are blanked and drawn two at a time and then split apart with no scrap between the bumpers. The double

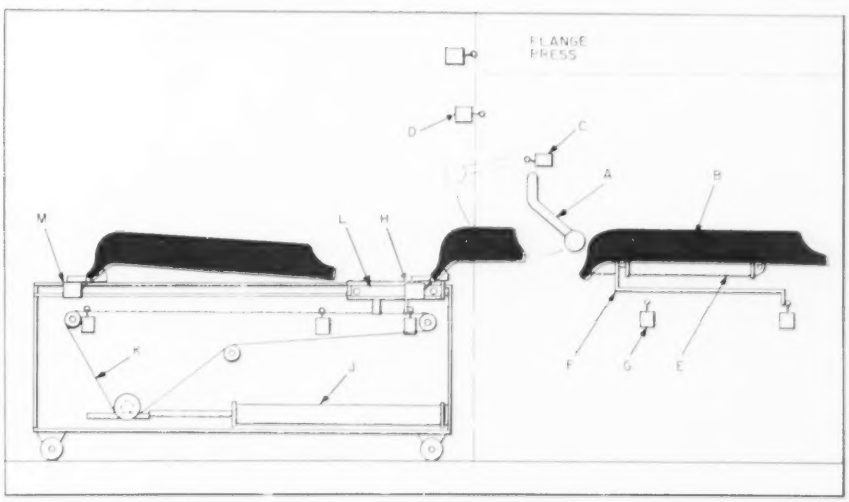


Fig. 8. Pusher (F) automatically unloads panel from flange press, and carriage (L) transfers hood to unloading station at left.

blanks, 97 1/2 inches long by 21 5/8 inches wide, are stamped from S A E 950 deep-drawing, cold-rolled steel sheets, 0.093 inch thick, on a Danly 500-ton, single-action, eccentric press.

After polishing, inspecting, washing, and Bonderizing, the flat double blanks are loaded into the Clearing 1000-ton, double-action crankless draw press shown in Fig. 10. The blanks are manually placed on thrust balls, and air-operated loader arms push the blanks into the preforming and drawing die. Upon completion of the forming operation, air cylinders raise two pins to lift the part 10 inches prior to removal with an "Iron Hand." Switches are provided so

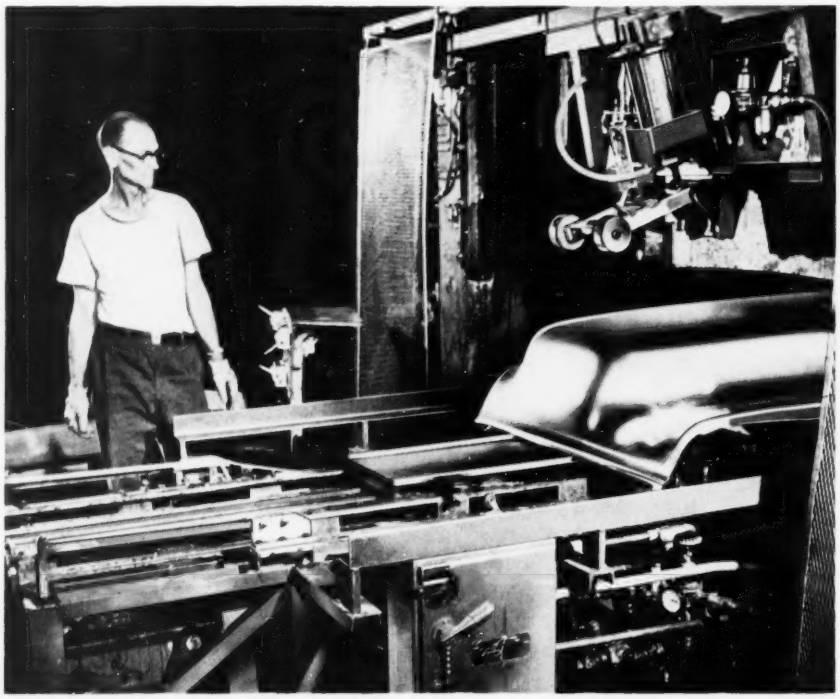


Fig. 9. Drawn, trimmed, and flanged hood panel being automatically pushed from flange press onto carriage.

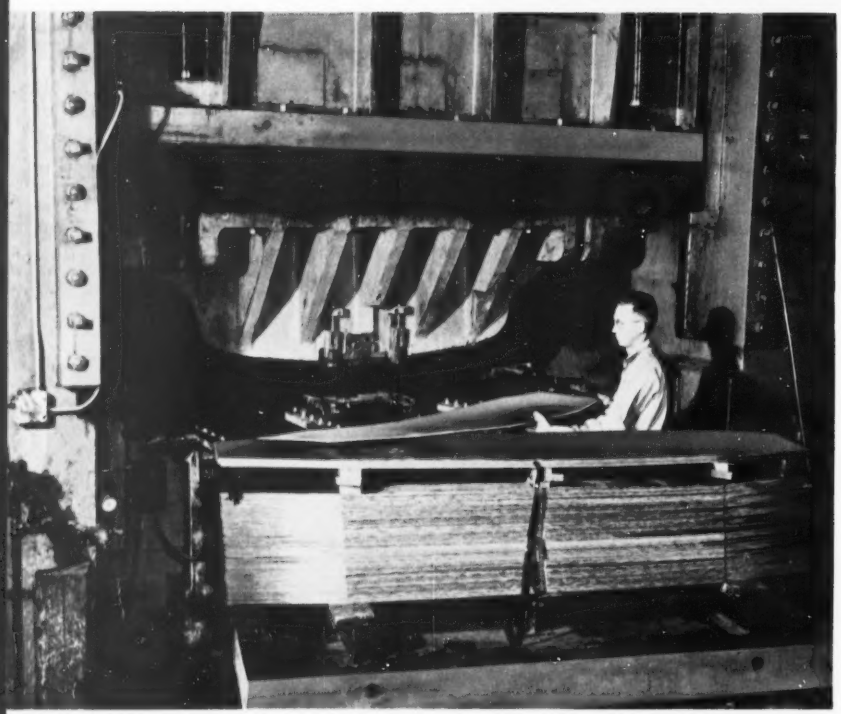


Fig. 10. Polished and Bonderized blanks are manually loaded into a 1000-ton, double-action press for drawing each of the blanks into two bumpers.

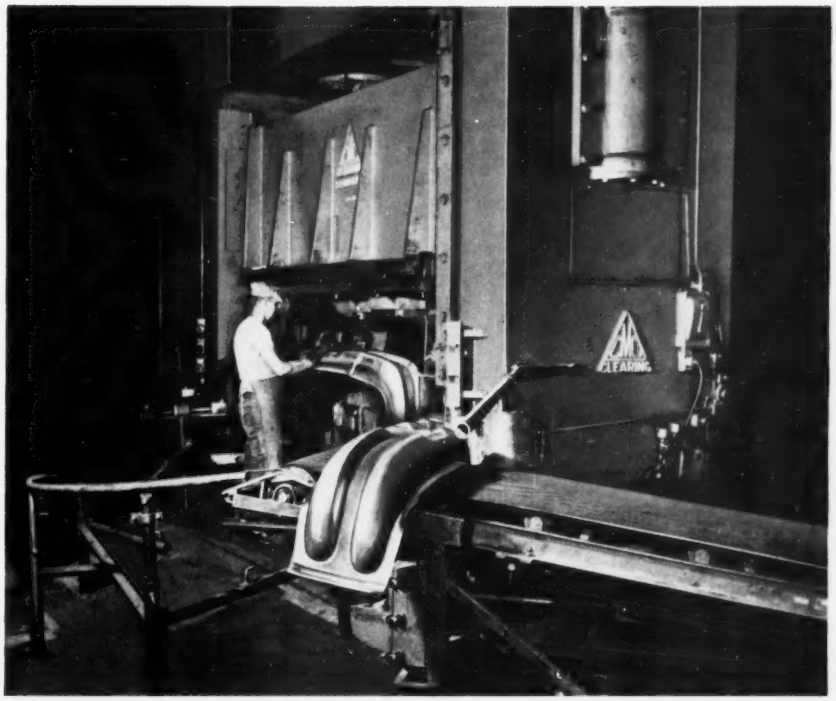


Fig. 11. An 800-ton, single-action press is employed to pierce square holes in a stamping and separate it into two rear bumper bars.

that the press cannot be operated until the drawn double bumper has been removed and a blank properly positioned in the die.

Automatic unloading is accomplished with the Sahlin "Iron Hand" mounted on the rear of the press frame as seen in the heading illustration. When the press ram rises, the jaws of the air-actuated mechanism swing into the die area, grasp the drawn double bumper, swing it out of the press, and drop it on a conveyor leading to the Clearing 800-ton, single-action, parting press seen in Fig. 11. The jaws are faced with neoprene pads in order to prevent scratching or otherwise marring the polished surfaces on the bumper.

A pipe projecting from the parting press tips the drawn parts into the required position for loading if the bumpers are open side up as they travel along the endless belt conveyor. A slide is provided on the parting press to load the double bumper from the rear of the press, and unload parted bumpers at the front of the press. In this die, two 0.531-inch square holes are punched in each stamping prior to parting. The parting die automatically unloads the parted bumpers and they are conveyed to the next operation.

Automatic Chip Processing

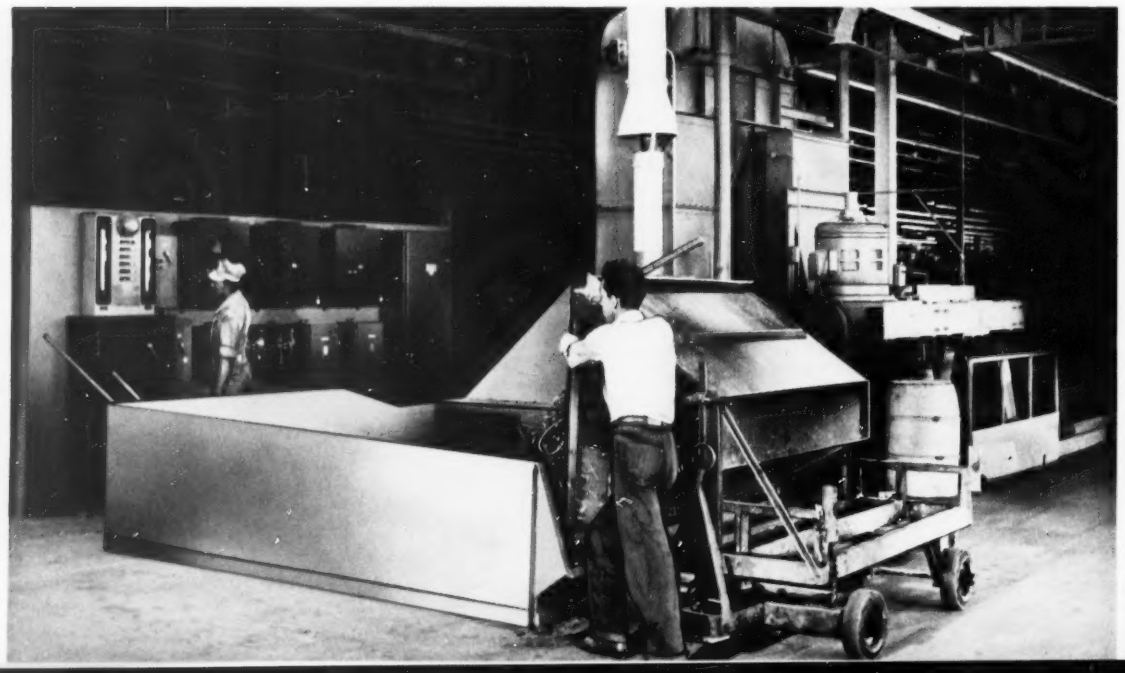
Cutting oil is automatically extracted from turnings and crushed chips are pneumatically conveyed to storage hoppers on railroad siding. Savings result from increased value of chips and reclamation of cutting oil

ONE of the most modern automatic chip processing systems in the country has been installed in Chrysler Corporation's industrial and marine engine plant at Trenton, Mich. With this system, turnings from the various machine tools are crushed, cutting oil is extracted, and the chips are pneumatically conveyed to storage hoppers located on a railroad siding—all automatically. Substantial savings have resulted from the reclamation of cutting oil, and the higher price received for the crushed, dried chips.

An over-all view of the automatic chip processing unit, designed and installed by the Turbine Equipment Co., New York City, is shown in Fig. 1. Steel and cast-iron turnings are kept segregated, the former being deposited in the pan shown and the latter in a similar pan at the right of the unit. Turnings are conveyed to the unit in tilting type, portable carts and dumped, as seen in the heading illustration. Only the steel turnings have to be crushed and fed through the cutting oil extractor, since most cast iron is machined dry and the chips are small.

The bottom of the uncrushed steel turnings pan is sloped so that oil drained from the turn-

Fig. 1. Over-all view of automatic chip processing unit. Steel turnings are dumped in the pan at left, while cast-iron chips are placed in a pan at right.



Pays Dividends at Chrysler

ings flows by gravity through a perforated plate and into a dirty oil sump tank. The pan, approximately 10 feet long and 6 feet wide with sides 3 feet high, serves as a storage area in which to accumulate enough turnings to warrant operation of the processing equipment. While the steel turnings are in the pan, they are manually pulled apart to some extent and the operator removes foreign objects such as bar ends, tools, work-pieces, rags, and soft drink bottles. While many of these objects will pass through and be broken up by the crusher, bar ends or work-pieces larger than 3/4 inch in diameter by 3 inches long cause excessive wear of the crusher and increase maintenance costs. Also, an excess of foreign materials will reduce the market value of the chips.

The only other manual operation required in the chip processing cycle is feeding of the turnings into the crusher loading pan, as seen in Fig. 2. To utilize the natural forces of gravity, the crusher and centrifuge type cutting oil extractor are mounted on foundations in a pit having a depth of 10 feet below the factory floor level. Fig. 3 is a cross-sectional drawing of the installation. The equipment needed for processing the steel turnings is shown at the left and center of this drawing, while that for cast iron is at the extreme right.

As the turnings fall down into the American Pulverizer crusher, they are caught between the rotating hammers and stationary grates, and broken into small chips. These chips fall through an opening in the bottom of the crusher into a discharge hopper. From here they are picked up by a bucket type conveyor, Fig. 4, that carries the chips up above the floor level and dumps them into a loading hopper located directly above a Teco self-discharging, centrifuge type, cutting-oil extractor.

At the start of the cycle, the extractor is operated at half speed (425 R.P.M.). This speed is attained in a few seconds after the starting

Fig. 2. Turnings are manually pulled apart so that foreign objects can be detected and removed, and are fed into crusher loading pan.

button is depressed, whereupon the extractor is automatically loaded with chips. Loading of the extractor while it is operating at half speed is accomplished automatically by means of a vibrating type feeder located directly below the discharge end of the hopper. The feeder is actuated by a time delay relay.

After a pre-set length of time, a second relay automatically shuts off the feeder and increases the extractor speed to 850 R.P.M. During loading and operation, centrifugal force holds the chips against the inner periphery of the basket and removes oil from them. The extracted oil is collected in a storage tank for subsequent sterilization and purification.

At the end of about three minutes of full-speed operation, a third timing relay automatically stops the driving motor and applies a brake to the extractor. Just before the basket stops rotating, centrifugal force is overcome and the chips fall through the open bottom of the basket into a discharge hopper seen at the top in Fig. 5.

In order to provide for metered flow of dry, crushed chips to the pneumatic conveying system, a vibrating type feeder is provided under the bottom opening in the discharge hopper. In the illustration, a hinged lid has been swung open to show chips on this feeder. The chips are fed at a uniform rate from the discharge hopper to a rotary air lock, seen at the lower left.

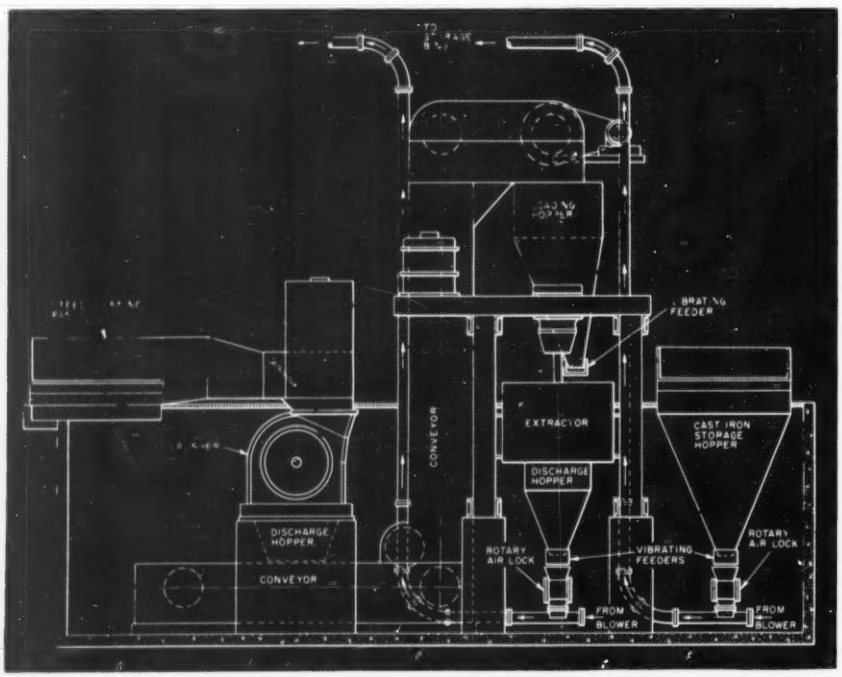


Fig. 3. Sectional drawing of automatic chip processing installation. Crushing and oil removal are required only on the steel turnings. Cast-iron chips are handled at right.

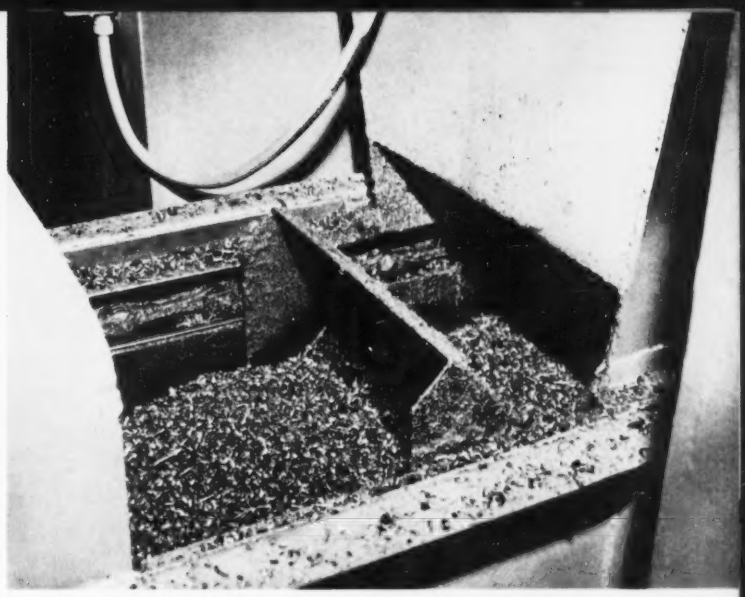


Fig. 4. Bucket type conveyor carries chips from crusher discharge hopper (upper right) to the hopper for feeding the extractor.

Air for the conveying systems is supplied by two Roots-Connersville rotary positive blowers, one for steel and the other for cast-iron chips. Each blower supplies 1000 cubic feet of air per minute at a pressure of 5 pounds per square inch gage. This volume of air carries chips of a given weight through the fixed diameter pipe of the conveyor system at a velocity of 6000 feet per minute.

The problem of getting the chips (which are at atmospheric pressure) into the air stream of the conveying system (which is under a pressure of 5 pounds per square inch) without blowbacks is solved by using the rotary air lock previously mentioned. The lock has a chain and sprocket motor drive, and is equipped with five equally spaced, radial rubber blades. These rotating blades form pockets for carrying the chips from the vibrating feeder to the conveying pipe, where they are picked up by the air stream. In this way, air under pressure is prevented from leaking into the atmosphere.

The air stream carries the chips through the pipe line and discharges them in one of three storage bins, each of 2000 cubic feet capacity. The bins are located about 1000 feet from the plant along a railroad siding, as seen in Fig. 6. Two overhead pipe lines carry the chips from the plant to the bins, one pipe carrying steel chips, while the other is for cast-iron chips. Control gates and unloading chutes on the storage bins are designed so that one man can load a railroad gondola car (which usually have a capacity of 1500 to 1800 cubic feet of chips) in fifteen minutes or less.

Bends in the pipe lines have large radii, and these sections, as well as joint fittings, are made from a hard, high-strength material because of the abrasive nature of the chips. Wall thicknesses in these pipe sections vary up to 1 inch. Straight sections of pipe immediately following the bends have straightening vanes to minimize turbulence of high-velocity chips. In addition, elbows and curved sections of the pipe line are provided with hand-hole covers to permit in-

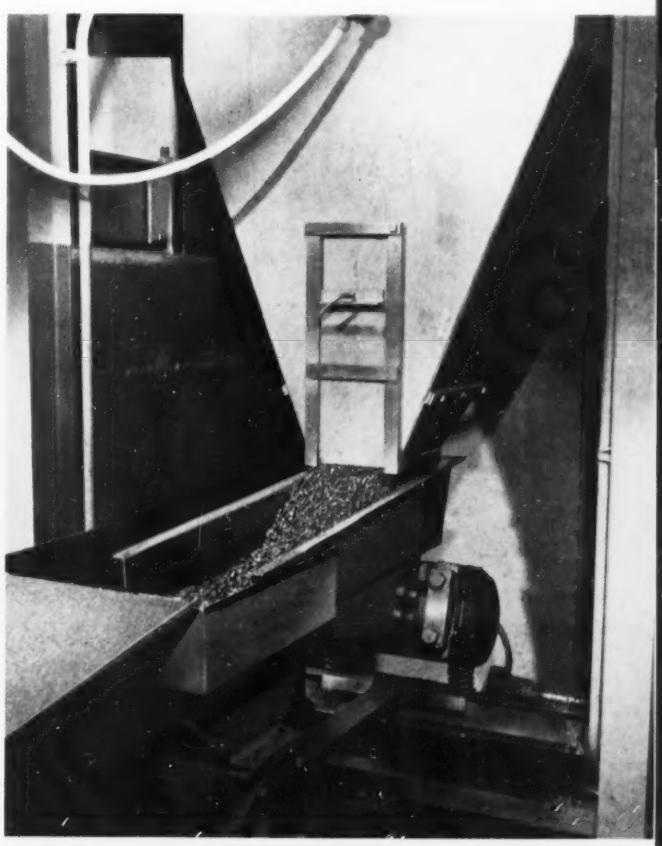


Fig. 5. Discharge hopper located below cutting-oil extractor drops chips onto vibrating feeder which directs them to a rotary air lock.

Fig. 6. Chips are pneumatically conveyed through pipes to three storage bins located outside plant at railroad siding. Each bin has a capacity of 2000 cubic feet.

spection and clearing the pipes in case there are obstructions.

The centrally located control panel for the chip handling system is shown in Fig. 7. A bank of signal lamps at the upper left-hand corner of the board indicates whether the various hoppers and storage bins are empty or full. The two manometers, one on each side of the signal lamps, indicate the air pressure in the steel and cast-iron chip conveying pipe lines.

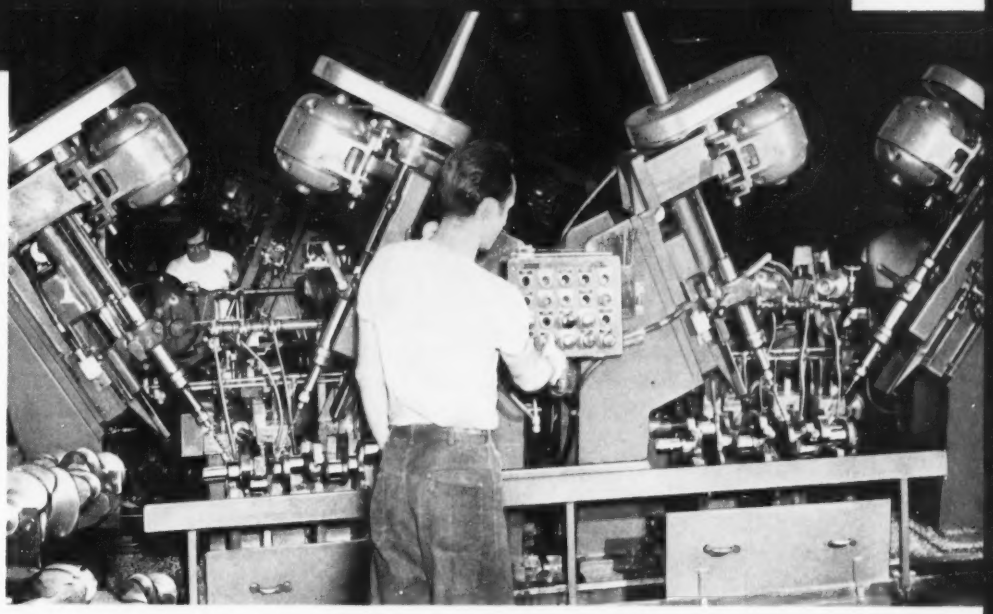
In addition to the savings previously mentioned, this rapid and economical method of chip removal also saves valuable floor space that can be used for productive manufacturing operations. Also, long and bushy turnings often fill a railroad car before the minimum allowable weight is reached, resulting in the payment of a tariff for a weight not in the car. This is eliminated with crushed chips. Since the outside storage bins hold enough chips to fill more than three railroad cars, demurrage on freight cars is eliminated.

Still another improvement is the cleanliness of the chip processing room. Doing away with manual loading and transporting of chip baskets has eliminated spillage of turnings and oil that formerly created an unsightly chip room and housekeeping problems. Cleanliness of the present set-up allows safer working conditions.

Fig. 7. Signal lights in upper left-hand corner of control board indicate whether the various hoppers and storage bins are full or empty.

Retracting Jigs Speed Studebaker Drilling

By EDGAR ALTHOLZ
Associate Editor



JIGS that guide slender drills to enter surfaces at an angle, then retract to minimize wear during the major portion of the feed stroke, are a feature of a battery of new Leland-Gifford crankshaft oil-hole drilling machines. They are operating in the crankshaft department at the Studebaker Corporation, South Bend, Ind.

Each machine consists of eight independently motorized drilling units supported on a special framework. The sixteen oil outlets in the crankshaft are produced by cross-drilling eight through holes at an angle to join pin bearing and main bearing surfaces. At one end of the machine, four holes are drilled at a time, after which the work is transferred to the other end of the machine, where the remaining four holes are drilled. Two crankshafts are processed at the same time, giving a production rate for the operation of better than 150 pieces per machine in an eight-hour shift.

An over-all view of one of the machines is shown in the heading illustration. Two drilling units can be seen at each end of the machine, "toed-in" from the vertical. Also, at each end and behind the work are two other units similarly positioned in a horizontal plane. Special fast-spiral drills, 1/4 inch in diameter and 10 inches in length, are supported in Erickson holders in each spindle.

The drilling distance of 4 1/2 inches through the crankshaft forging is completed in 1/4-inch steps; at each step, the drills momentarily withdraw to clear the flutes of chips. All eight drilling units feed in unison, their quills being hydraulically actuated from a central push-button panel. Also controlled from this panel and integrated in the hydraulic system of the machine are work-clamping and jig-retracting mechanisms. It is the jig-retracting feature that makes the design of the machine unique.

At the beginning of the cycle, immediately after the work has been secured, the jigs containing the bushings advance, aligning the bushings ahead of their respective drills. The close-up

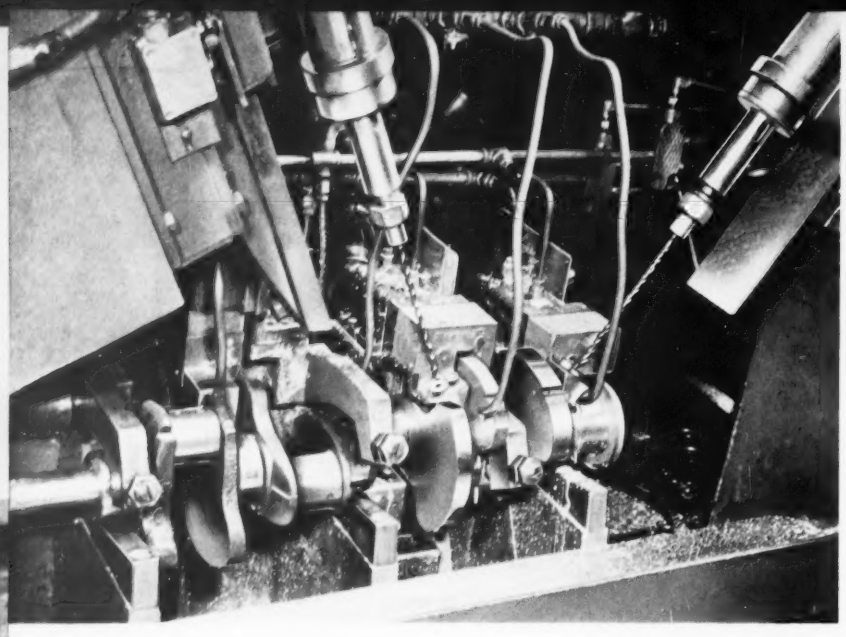


Fig. 1. In the advance position of the jigs, the bushings are in line with the drills.

view, Fig. 1, shows this position. With the spindles revolving, the quills execute a rapid approach stroke, the drills enter the bushings, and the quills begin their feed stroke.

For the first 1/2 inch of depth, the advance position of the jigs is retained, guiding the drills to enter the work surface at an angle without deflecting. Then, with the automatic withdrawal of the drills at this point, the jigs retract and the drills re-enter the holes, as in Fig. 2, operating without passing through the bushings for the remaining 4 inches of depth.

Thus, the bushings serve the purpose of guiding the drills for the critical initial travel. At the same time, the physical contact of the drills with the bushings and the abrasion in the bushings produced by the chip flow are largely avoided. The result is substantially longer drill and bushing life than was possible when stationary jigs were used. What is more, with the bushings out of the way for all but the first 1/2 inch of drilling depth, chip jams in the bushings are highly improbable. In the past, chip jams have frequently caused drills to break off in the holes. The interruption to production, the replacement of the drill, and the expense of salvaging the crankshaft forging by extracting the frozen end of the drill all used to contribute toward costly operation.

Two push-buttons control the complete drilling cycle. Depressing one button clamps the work, advances the bushing jig, step drills for the first 1/2 inch, and then withdraws the quills. Depressing the second button retracts the bushing jigs, step drills for the remaining 4 inches, withdraws the quills, and automatically un-

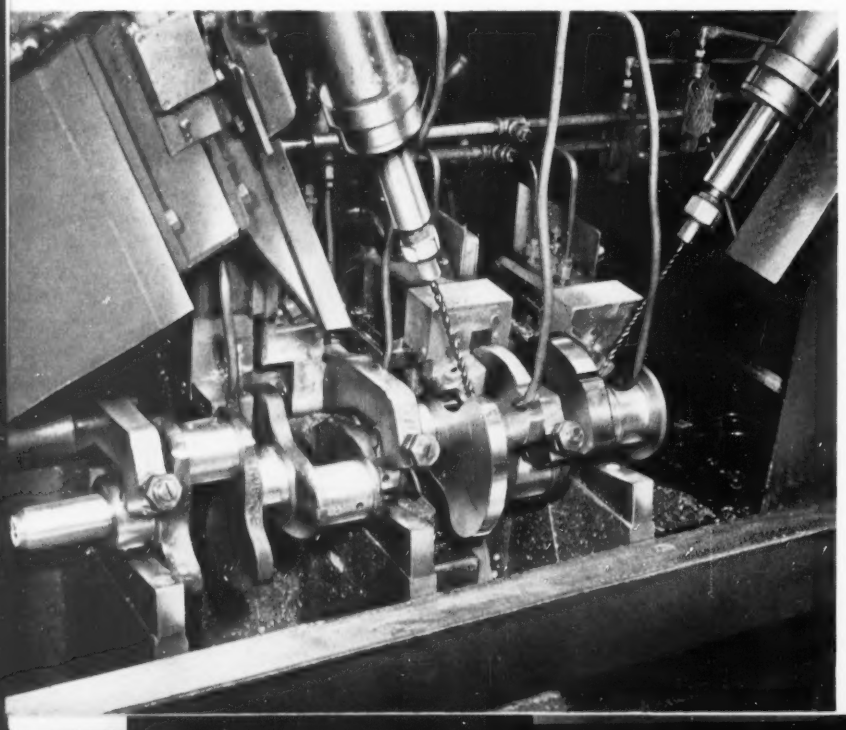


Fig. 2. With the jigs retracted for the major portion of the feed stroke, drill wear and breakage are largely avoided.

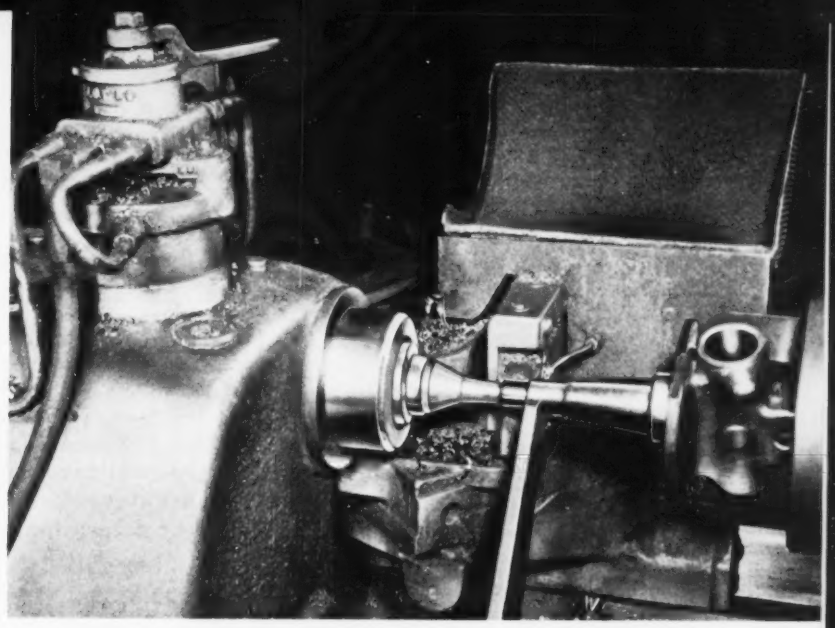


Fig. 3. Spray coolants are being adapted to many operations, such as turning steering knuckles.

clamps the work. Actual drilling time is one minute fifteen seconds, with an average drill life of forty-five holes between regrindings.

Spray Coolant Used in Turning Steering Knuckles

Another significant metal-working innovation at Studebaker is the use of a spray coolant on the steering-knuckle line in turning the forging body. The operation is performed between centers with a single-point carbide tool on a row of Monarch "Mona-Matic" lathes. These tracer-controlled machines have a rapid rate of metal removal. The attendant heat has dictated the use of an effective cooling method to assure close dimensional control and long tool life.

An Acro unit installed at each machine delivers a water-soluble coolant in spray form through the orifice of a tube near the heel of the tool. In the rear view of the lathe, Fig. 3, the coolant tube can be seen to the right of the toolpost. The advantage of the spray is that it is directed *behind* the wedge formed by the chip as it is peeled off the work. In this way, the spray impinges on the face of the tool (in contrast to a flow coolant, where the obstruction of the chip in the stream subjects the tool to intermittent thermal shock).

A view of the coolant unit is shown in Fig. 4. The shop air line passes through a filter and pressure regulator, seen to the left of the coolant reservoir. (In this application a pressure of 40 pounds per square inch is maintained.) A line from the regulator leads to an injector on the right of the reservoir, and a branch enters the reservoir. Air and liquid coolant blend at a needle valve in the injector, forming a mist which flows down a delivery line.

The coolant used for the operation is a solution of 1 part of Lusol to 20 parts of water. Although the spray is expendable, it is economical to use, the 3-gallon coolant capacity of the reservoir being ample for an eight-hour shift. The steering knuckles come off the machine cool enough to be handled. Operators like the good work visibility and the reduced likelihood of skin infection afforded by the spray coolant.

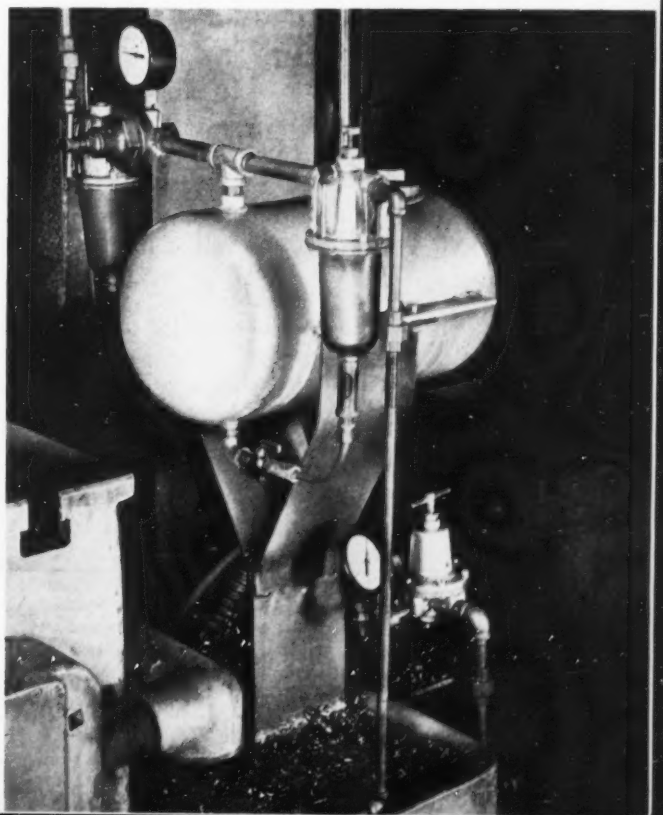


Fig. 4. This compact unit installed at the machine delivers a soluble oil mixture in a spray behind the wedge formed by the chip and the work.

How Form Tolerances Affect Gaging Requirements

Part II

Tolerances are established to control variations in size, form, position, and function. In this sixth of a series of articles on dimensions and tolerances for mass production, the author shows how tolerances on form—particularly profiles—are selected and how they determine the gaging requirements

By EARLE BUCKINGHAM
Professor of Mechanical Engineering
Massachusetts Institute of Technology

Tolerance on Form of Cylinder—Another condition of form is that of a cylinder when its accuracy of form is more important than its accuracy of size. Such conditions exist on the bearing surfaces of high-speed shafts. Ordinarily, the tolerance band defined by the tolerance on the diameter of a cylinder also includes errors of form unless some further specification is given. If the cylindrical form is of great importance, the detail drawing indicates this by a notation which may read: *CYLINDRICAL WITHIN 0.0003 inch.*

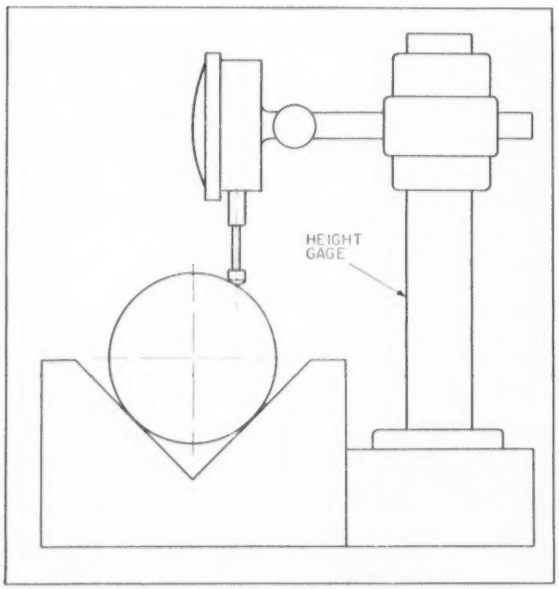


Fig. 11. For inspection, cylinder rests in a V-block with a dial indicator gage mounted above it and off center. As cylinder is slowly rotated, the reading provides a direct measure of the accuracy of the form.

For inspection, the cylinder rests in a V-block with a dial indicator gage mounted above it and off center, as shown in Fig. 11. The cylinder is rotated slowly in the V-block and the hand of the dial indicator gage registers any errors in form. The gage reading is accepted as a direct measure of the accuracy of the form. If the form is that of a true cylinder, there is no movement of the indicator hand. An acceptable part requires that the movement of the indicator hand not exceed the amount specified by the tolerance.

Tolerance on Flatness and Parallelism—Still another condition of form which is quite similar to the foregoing is that of the flatness or straightness of a plane surface. The notation on the detail drawing, when this factor is of great importance, may read: *FLAT WITHIN 0.0003 inch.* The inspection for this condition is made with a height gage that carries a dial indicator gage. The component with the plane surface to be inspected is mounted on a surface plate with the plane surface leveled to the surface of the plate. The height gage is moved along the surface plate with the indicating element of the dial indicator gage resting on the surface to be tested. The dial indicator gage reading must not exceed the specified amount.

A similar test is made for the parallelism of two plane surfaces. In this case, one of the parallel surfaces is the datum, or registering surface, for the height gage and the indicating element of the dial indicator gage travels along the second surface. The notation will read: *SURFACES PARALLEL WITHIN 0.0003 inch.*

Inspection of Form of Thread on Worm—One of the most complex problems of specification

and control of form is that of the form of the thread of the worm member of a worm-gear drive. The actual form of this thread depends upon the lead and diameter of the worm, and the type, size, form, and setting of the cutting or grinding tool used to finish the worm thread surfaces. The actual thread form in an axial section of the worm may vary between a straight line, a concave curve, a convex curve, or a form of double curvature.

In the past, it has been common practice to specify the form of the thread of such worms as the form in the normal section of the worm. Such a specification is indefinite; the only definite way to specify the worm thread form is in terms of the tool used to produce it. The type and size of the cutting tool, the form of its cutting edge, and its cutting position in relation to the worm must all be given to establish the form of the thread. An example is shown in Fig. 12. This is a double-thread worm.

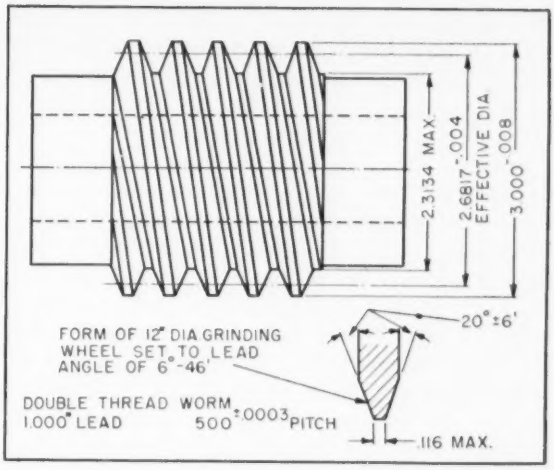


Fig. 12. The only definite way in which the form of a worm thread can be specified is by indicating the type and size of the cutting tool, the form of its cutting edge, and its cutting position in relation to the worm.

Importance of Thread Form—Many of the elements or conditions of size of such a threaded component are treated in the same way as the equivalent elements of a screw thread. But here the actual form of the thread itself is of paramount importance; that is, the form of the thread on the worm and that on the hob which is used to generate the conjugate worm gear teeth must be as nearly identical to each other as it is possible to make them. For correct conjugate action, the exact form of the thread on the worm and hob is of small importance—except for high lead angles when the center distance must be kept to a minimum—but the identity of form of thread on worm and hob is of the utmost importance. Only when the form and setting of the finishing tool for the threads of the worm are definitely specified will the thread form be fixed and defined so that it can be duplicated whenever necessary.

The outside diameter of the worm is a condition of size and it should be treated accordingly. Only the maximum root diameter (minor diameter) is specified. This is also a condition of size and its maximum value controls the minimum amount of clearance between the worm and its mating worm-gear. More clearance here does no harm. The effective diameter (that diameter on the worm where the thread thickness and space width in an axial section are equal) tolerance controls the thickness of the thread and the amount of backlash in the drive. This effective diameter can be measured with the use of two or three wires set in the thread spaces. Only two wires are needed with the double thread specified in Fig. 12. This measurement is the same as the wire measurement of screw threads. The accuracy of the indexing of the threads is most important. This can be controlled by the introduction of a very small tolerance for the pitch of adjacent threads and can be measured by the use of a special pitch gage as shown in Fig. 13. A dial indicator gage is employed with a registering finger which is applied to the worm thread when the component is mounted on an arbor and set up in a pair of centers, as illustrated.

Checking Angle of Thread—The angle of the thread is also an important element. Both sides of the thread must have the same angle within close limits. A master worm is essential here to maintain uniformity, particularly when the quantity of production is large. This angle can be measured—or rather compared—with the aid of a sine-bar angle testing device such as seen in Fig. 14.

The device consists of a plate which carries a swiveling member containing means for clamping in position a special gaging finger of the general nature of a thread chasing tool. The sides of this finger are relieved to clear the helix of the thread and to provide a knife-edge to contact the thread form.

A cylindrical stud is accurately positioned in relation to the pivot of the swiveling frame at a distance of 5 inches from the pivot. Two flat datum surfaces from which the position of the cylindrical stud can be measured form a part of the base. An external measurement of the distance *A* or an internal measurement of the distance *B* with size blocks gives the value of the angular position of the swiveling frame. If, for example, the angle of the swiveling frame is

zero when A is equal to 1.0000 inch or B is equal to 0.5000 inch, then for any other position the sine of its angle is equal to the difference in these measurements from the zero value divided by 5, or multiplied by 0.2.

When the lead angle of the worm is small, the top surface of the gaging finger can be set in an axial plane of the worm. The worm is mounted on an arbor which is carried between bench centers or between the centers of a bench lathe with the angle testing device mounted on the carriage of the lathe. As the lead angle increases, the curvature of the thread form also increases so that it is not possible to determine the correct position of the gaging finger to the degree of accuracy required. Incidentally, the test of the accuracy attainable is to make repeated measurements of the same set-up and compare the readings with each other. The differences in these readings give a close measure of the extent of the observational error.

With increasing curvature of the thread form, the plane of the top surface or the plane of the knife-edges of the testing finger can be adjusted up or down in reference to the axial plane of the worm until a practically straight-line profile of the thread form is reached. The actual angle of the thread form changes with such shifting but this does not matter. The base setting of the angle testing device is established from a test of the master worm. One side only of the thread form is tested at a time. After the first side of the thread is tested, the worm and arbor is reversed in position, end for end, between the centers with no alteration in either the vertical height or the angular setting of the angle testing device. It may be moved radially for clearance during the change of position of the worm, and axially to make contact with the opposite side of the thread after the position of the worm is reversed. Any difference in the angular reading on the two sides of the thread is a measure of the error of symmetry of the thread form.

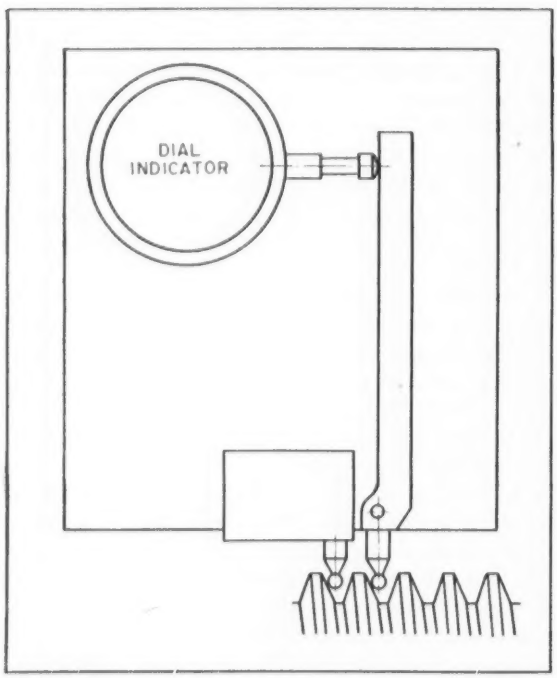


Fig. 13. A pitch-measuring gage of the type shown can be used to determine the accuracy of the indexing of the threads on multiple-thread worms.

The accuracy of angular measurement attainable depends largely upon the depth of the thread or the length of the contact between the gaging finger and the side of the thread form. The symmetry of the thread of the master worm can be checked accurately in this way. With the angle of the setting of the swiveling frame carrying a given gaging finger and the off-center position of the plane of the knife-edges, up or down as the case may be, established from the master worm, duplicate master worms can be accurately made if the need arises. The accuracy of the angular setting on a worm thread of 1/2 inch pitch, as an example, can be definitely checked to 5 minutes of arc or better.

The foregoing tests give a close control of the form of the worm threads. They are made to check the initial set-up for production. They cover (1) the variation in the thread thickness, which is limited by the tolerance on the effective diameter of the thread; (2) the variation in the pitch, which should be limited by very small tolerances in the pitch of adjacent threads (which, in turn, control the variations in the lead and indexing of multiple-threaded worms); and (3) the thread form which should be limited by a tolerance on the half-angle of the thread form, as well as a comparison with the master worm by means of the sine-bar angle-testing device.

Checking Form of Hob for Worm Gear—In order to control the form of the teeth in the conjugate worm gear, the form of the teeth in the hob must be tested. The only specification of the tooth form of the worm-gear is by reference to the mating worm thread. The form of the cutting edges of the teeth in the hob can be tested very definitely and simply as follows: The hob is mounted on an arbor and set up in the worm thread grinding machine exactly as though it were a worm to be finish-ground. It is understood that a worm from the given set-up has been tested for its conformity to the master worm.

The hob teeth are relieved and the angle of the radial relief will be about 5 degrees or less.

With a 20-degree half angle of thread, this will give an axial or side relief angle of something less than 2 degrees, or an angle with a tangent of about 0.031. (The exact angle can be readily calculated when the amount of radial relief per tooth is known.) A light grinding cut is taken on the sides of the teeth of the hob until all of the side along the cutting edge has been cleaned up, with a minimum width at any point of 0.010 inch or so. Even with a ground hob, the line representing the intersection of the unrelieved worm thread form, which has been produced by the light grinding cut, and the relieved surface of the sides of the hob threads, will be very evident to the eye.

The nature of any error in the form of the thread on the hob will be very evident from the form and position of this intersection line as indicated in Fig. 15. If it is parallel to the edge of the cutting flute, the form of the hob thread is correct. If the widths of the lands on all the teeth are the same, both the pitch of the teeth and the positions of all the cutting flutes of the hob are correct. If these widths are different, the amount of difference gives a measure of the specific errors.

Errors Indicated by Size and Shape of Lands—If the position of the intersection line is as shown at *A* in Fig. 15, wide at the top and narrow at the middle of the tooth and wide again at the bottom, the hob thread form is full at the tip and at the root. A slight amount of variation of form in this direction and of this nature is acceptable since it eliminates edge contact at the beginning of mesh of the worm and gear. Any edge contact at the beginning of mesh on any type of gear is a very detrimental condition. In other words, the intersection line as shown at *A* in Fig. 15 is the direction of the permissible error in the form of the hob teeth. It must, however, be held within small limits.

The amount of the error can be approximated closely by measuring the position of the intersection line from the cutting edge or the width of the land produced by the light grinding cut. Subtracting the value at the narrowest point from all other values, the differences will indicate the nature, position, and amount of the error in form. With 2 degrees side relief for every 0.001 inch error in the hob thread form this intersection line will be displaced about 0.031 inch. This makes it possible to obtain a close measure of any errors present.

In addition to this, if the widths of these lands are different on the different teeth along one flute, then errors in pitch can be determined in the same way. If these widths are different on successive teeth along the same helix of the thread, this gives a measure of the accuracy of the indexing of the cutting flutes. All in all, this method gives a searching test of the accuracy of the hob.

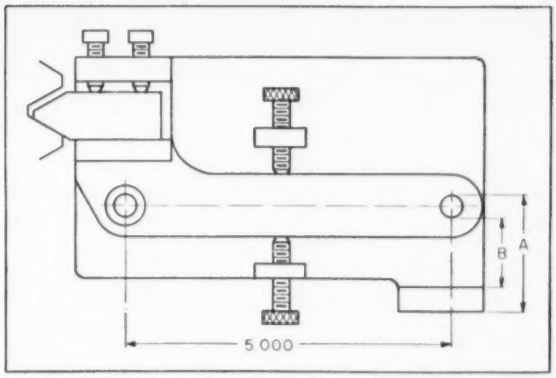


Fig. 14. A sine-bar angle testing device may be used to compare the angles on both sides of a worm thread.

If this intersection line is as shown at *B* in Fig. 15, with the land widest at the middle of the thread form of the hob and narrow at top and bottom, the hob thread form is full at the middle and will tend to develop edge contact at the beginning of mesh. Such a condition is not acceptable; such a hob is worthless. The extent of this error in form can be determined in the same manner as before.

If the intersection line is as shown at *C* in Fig. 15, with the band narrow at the tip of the thread and wider at the root, the half-angle of the thread is too large, that is, the thread half-angle error is plus. The amount of this error can be determined as before. This variation must be within the specified tolerance for the half-angle.

If the intersection line is as shown at *D* in Fig. 15, with the land wide at the tip of the thread and narrow at the root, the half-angle of the thread is too small, that is, the thread half-angle error is minus. The amount of this error can be determined as before. The extent of this variation must not exceed the specified tolerance for the half-angle.

The form and position of this intersection line may be different on the two sides of the same tooth of the hob. This gives a measure of the error in symmetry of the hob thread. Again, the amount of this error or difference may be determined as before. As far as correct conjugate gear tooth action between the worm and the mating worm-gear is involved, it is the degree of identity between the worm and the hob that is important and not the absolute accuracy of either to some theoretical design sizes and forms. The small side relief angle on the hob teeth gives an enlargement factor as regards the linear posi-

tion of the intersection lines. The error in the hob form normal to the thread surface is equal to the reciprocal of the tangent of the side relief angle (or the cotangent of this angle) multiplied by the difference in the width of the land.

If the hob is accurate enough to be used, the width of the ground and unrelieved surface at the cutting edge needed to make these tests will be small, and the hob can be used in this condition to generate the worm-gear. This unrelieved land will soon be ground away as the hob is resharpened. If the conditions of error are such that the width of the unrelieved land would make the hob cut incorrectly, the error is too great to use the hob in any case. The foregoing test is very revealing and makes evident all differences between the hob and the ground worm which it is supposed to duplicate.

Summary

Other problems involving conditions of form relate to angles and tapered surfaces. These have so many features more or less unique to themselves that they will be treated separately later. To summarize the problems of tolerances on the conditions of form thus far considered, one of the two following conditions must be met:

1. The metal tolerance on the profile (always measured normal to the form) includes all variations in conditions of size. In this case, the metal tolerance establishes a tolerance band around the form which must contain all variations in both size and form. When the product is at the maximum metal limit size, the form must be perfect. This same condition exists when the tolerance is given on a condition of size and the accuracy of form is involved. Here the tolerance on the conditions of size establishes a tolerance band within which all errors of both size and form must lie.

2. The form is held to closer tolerances than those permitted by the tolerance band established from the tolerances on the conditions of size. In this case, an additional and more restrictive specification of permissible errors in form must be added. The accuracy of form then must be measured directly by means of some type of comparator, except in the cases of cylinders and planes. These, to a certain degree, permit measurement directly with the aid of a simple set-up and the use of some indicating device, such as a dial indicator gage.

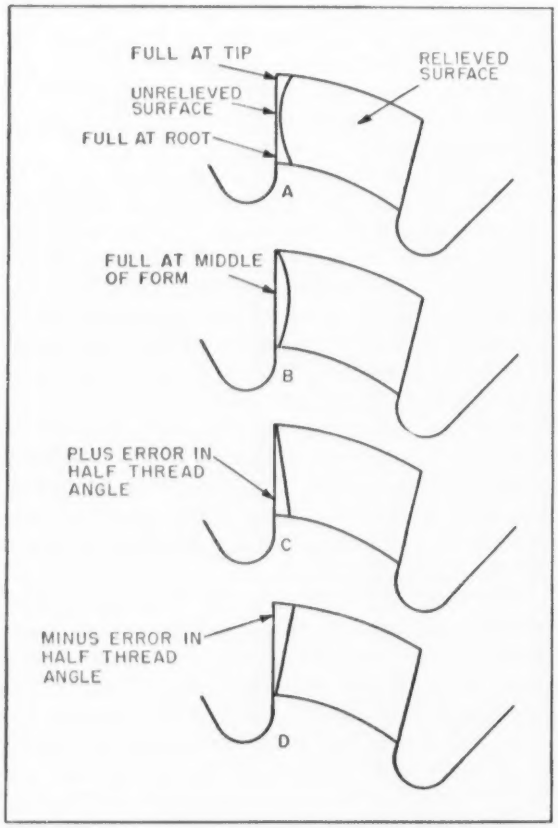


Fig. 15. In checking the form of the thread on a worm-gear hob, the nature of errors in the form will be evident from the form and position of the line of intersection of the unrelieved worm thread form and the relieved surface of the sides of the hob threads.

* * *

American Metal Powder Industry Now Leads Europe

How domestic powder metallurgy has forged ahead of the industry in Europe was depicted in a talk by Kempton H. Roll, powder metallurgist and assistant to the secretary of the Metal Powder Association. The speech was given at the Park-Sheraton Hotel in New York City before a group of distinguished metallurgists visiting the United States under the auspices of the Foreign Operations Administration.

The evidence cited in comparing the growth of the metal powder industry in the United States today with the same industry in Europe was the notable increase in consumption of metal powders, together with the rapid expansion of powder-producing capacity as well as part production facilities. Such growth has been reflected in vastly increased applications of metal powder parts. For example, one of the leading manufacturers of business machines is now making more than ninety different parts of powdered metal, with a still greater number being tooled up. This company is now producing powder metal parts for its own consumption at a rate of more than 36,000,000 a year.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Blanked Parts Utilize Entire Strip Stock

By FEDERICO STRASSER, Santiago, Chile

The reverse F-shaped part, Fig. 1, coordinates good product and die design. It is made from 0.018-inch thick silicon steel strip and subsequently becomes an element of a lamination in a small transformer. The production of the part is of interest because, in being blanked from the strip, a second part of identical configuration is left as "waste." Thus, two parts are completed in each cycle of the press.

In addition, the parts utilize the entire strip stock. The lay-out, Fig. 2, shows the arrangement of the parts on the strip. There are no bridges left after blanking, the scrap being limited to small slugs of the four holes pierced in each part.

A diagram of the die set-up is seen in Fig. 3. When a strip *A* is initially fed into the press, its end is located against a starting stop *B* while the required eight holes *C* in the first two parts are pierced. Thereafter, the end of the strip is located against a second stop *D*, so that while a part in work (beneath the punch *E*) and a "waste" part *F* are being formed, the holes in the next two parts are simultaneously pierced.

The part blanked by the punch is permitted to drop in the customary manner through the bot-

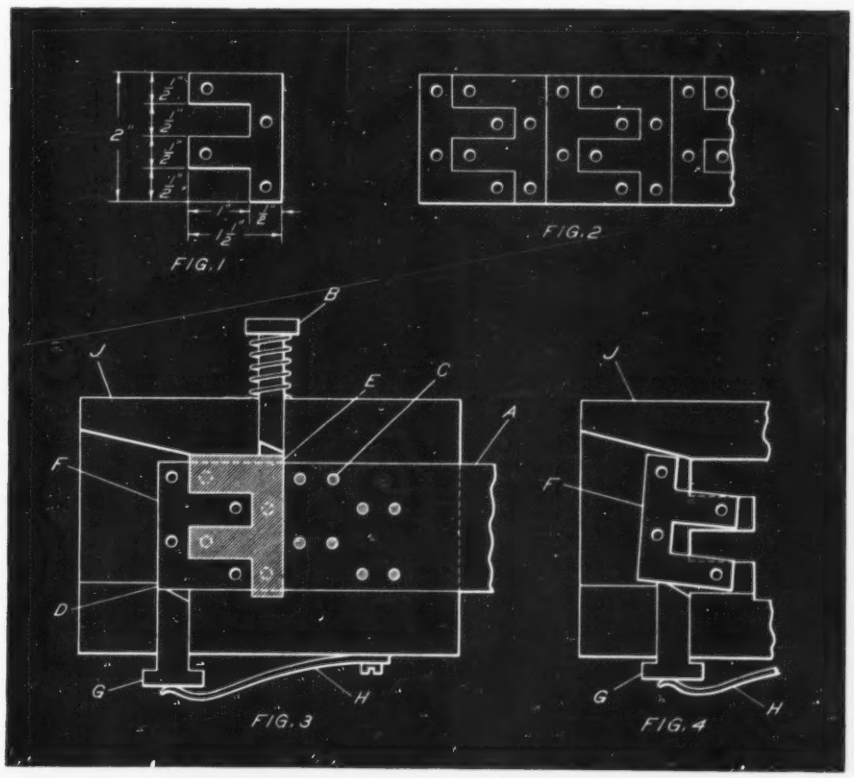


Fig. 1. Except for the slugs of the pierced holes, this part utilizes the entire strip stock. Fig. 2. Adjacent parts interlock—the waste part on the left, the punched part on the right. Fig. 3. Before the punched part is severed, the ejector (G) is retracted. Fig. 4. The waste part is pushed out of the side of the die.

tom of the die-bed. Provision for removing the waste part is made as follows: In advancing the strip against stop *D*, an ejector *G* is retracted against the pressure of a leaf spring *H*. When the punch clears the die on the up stroke of the press ram, the ejector pushes the waste part against the rear stock gage *J*, as in Fig. 4. The end of this gage is cut away, so that when the strip is again advanced, it pushes the waste part out of the die.

Pressing Bushings with Pneumatic Support Mandrel

By H. G. FROMMER, Milwaukee, Wis.

When pressing large bushings into steel castings or steel plates, it is highly desirable to use a support mandrel to give the bushing a straight start, to prevent collapse or distortion of the bushing, and to facilitate alignment. Customarily, a spring-loaded mandrel is the solution to such a problem. This is accomplished as shown schematically in Fig. 1.

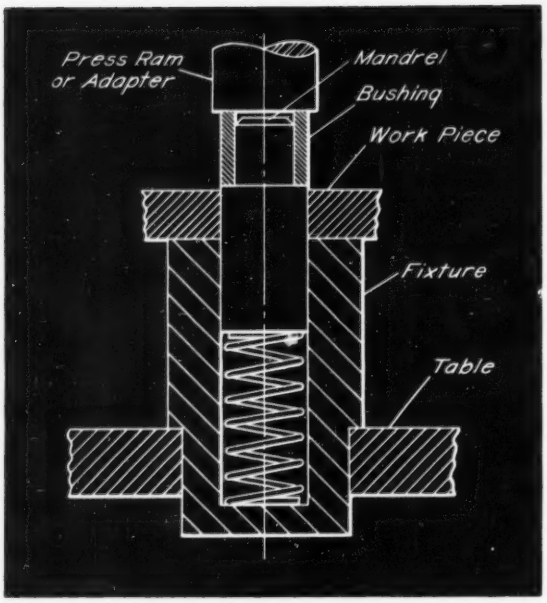


Fig. 1. Spring-loaded support mandrel customarily used in assembling bushings

There are, however, several disadvantages to this method. First, it is difficult to design such a fixture for a variety of work because different sizes of springs and mandrels are required to meet the conditions of the particular operation. Second, springs fatigue easily under heavy usage and the starting position of the mandrel becomes inaccurate. Third, for longer bushings the fixture must be rather high. Finally, when compressed considerably, the force exerted by the spring becomes too great for safe operation, as it tends to throw the work off the fixture too fast after completion of the pressing operation.

In order to overcome these difficulties, an air-supported mandrel was designed and built as shown in Fig. 2. The fixture body, cylinder *A*, is a weldment consisting of a length of heavy tubing and a steel flange cut from plate stock. Machining operations on this weldment consist of boring; counterboring; internal grinding; drilling and tapping four holes for the cover; and facing the under side of the flange for mounting on the press table. Air supply and bleeder holes are drilled horizontally through the flange.

Liner *B*, also a weldment consisting of tubing and a steel flange, is pressed into the cylinder. This liner is bored and honed, and is provided with a milled flat for air passage between it and the cylinder. The main reason for using a cylinder liner is for replacement purposes—the moving piston with its seal will eventually wear the cylinder, and for economy's sake it is preferable to replace a simple liner rather than the main fixture body. Piston *C* is a weldment made of tubing and two steel plates. The top end of the piston is machined larger than the body to provide just the correct amount of upward thrust when air is injected.

The force acting upon the piston equals the effective area times the line pressure, and is found as follows:

$$A = \frac{\pi}{4}(D^2 - d^2)$$

in which

A = Effective area
D = Larger (upper) diameter of piston
d = Smaller (body) diameter of piston

In the fixture described, the larger piston diameter is 4 1/2 inches, the body diameter is 4 1/8 inches, and the line pressure is 100 pounds per square inch. Using the formula

$$A = \frac{\pi}{4}(4.5^2 - 4.125^2) = 2.5 \text{ square inches.}$$

Therefore, the total force acting on the piston equals

$$2.5 \times 100 = 250 \text{ pounds.}$$

The force of 250 pounds is enough to counteract the weight of the piston, mandrel, and bushing but not too high for safe operation, as it would be insufficient to lift the heavier workpiece. Moreover, a pressure regulator in the air supply line will allow accurate adjustment of the pressure to control the force, a feature not readily obtainable in the spring type support mandrel.

Piston cover *D* confines the piston seal *E*,

which is a leather-backed O-ring, while piston stop *F* limits the upward piston travel. Cylinder cover *G* retains two more seals *H*—the lower piston seal and the cylinder seal, both being leather-backed O-rings also.

An adapter *J* with the inside diameter equal to that of the work-piece fits into the top opening of the cylinder liner. Obviously, a different adapter is required for work-pieces with different hole diameters. However, this is the feature that makes this fixture adaptable for a wide variety of work. The mandrel *K* that receives the bushing moves within the adapter. It is shown in the starting position in Fig. 2.

The operation is simple and fast. The piston moves the mandrel upward through constant air pressure from the supply line until the piston stop limits the movement. The work-piece is slipped over the mandrel and the bushing is dropped on the mandrel recess. Then the pressing operation is started, and the mandrel and piston are forced downward. If the air pressure is adjusted correctly, the mandrel will remain in the position it had at the end of the pressing operation until the work-piece is removed, at which time it will return automatically to the starting position for the next cycle.

Bushings of the oil-impregnated type are usually designed for a collapse of several thousandths of an inch by their makers. The mandrel fixture described here is a great help in controlling such a collapse. In the process of controlling, however, the inside diameter of the bushing may grip the mandrel tightly and thereby make its removal difficult. It then becomes necessary to use a smaller press ram adapter and press the mandrel out of the bushing at the end of the normal pressing operation.

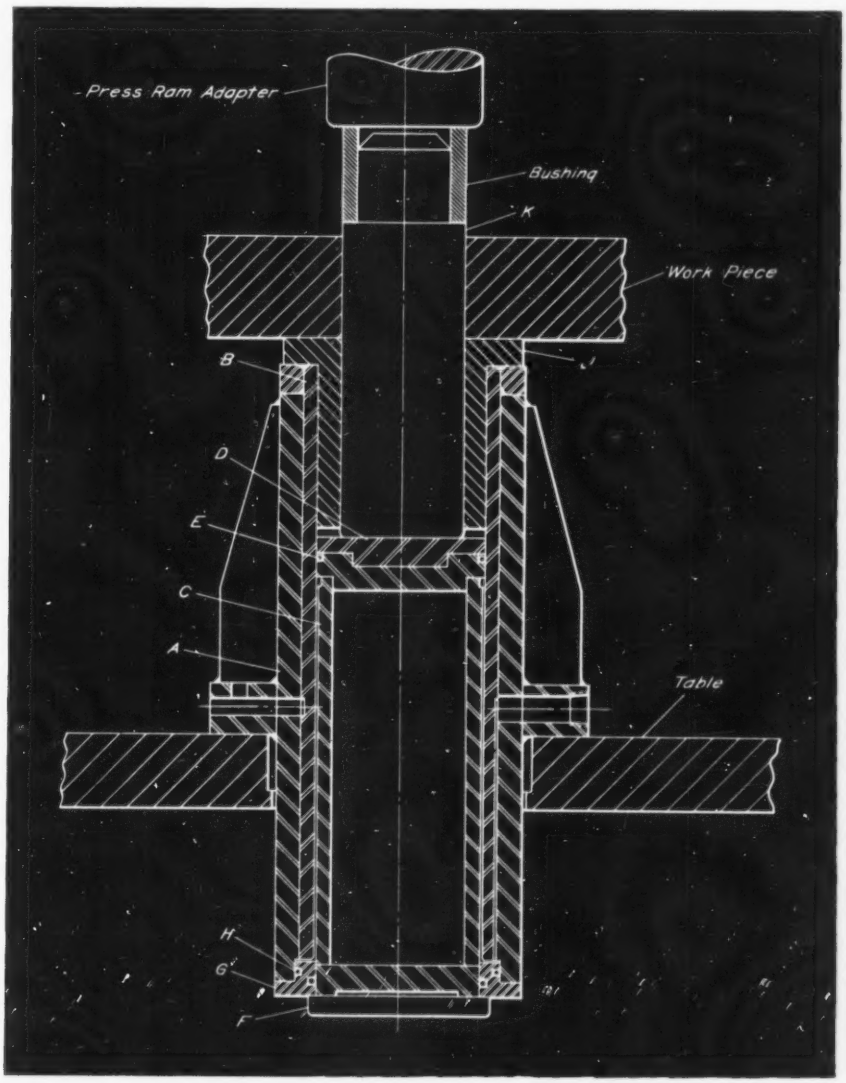
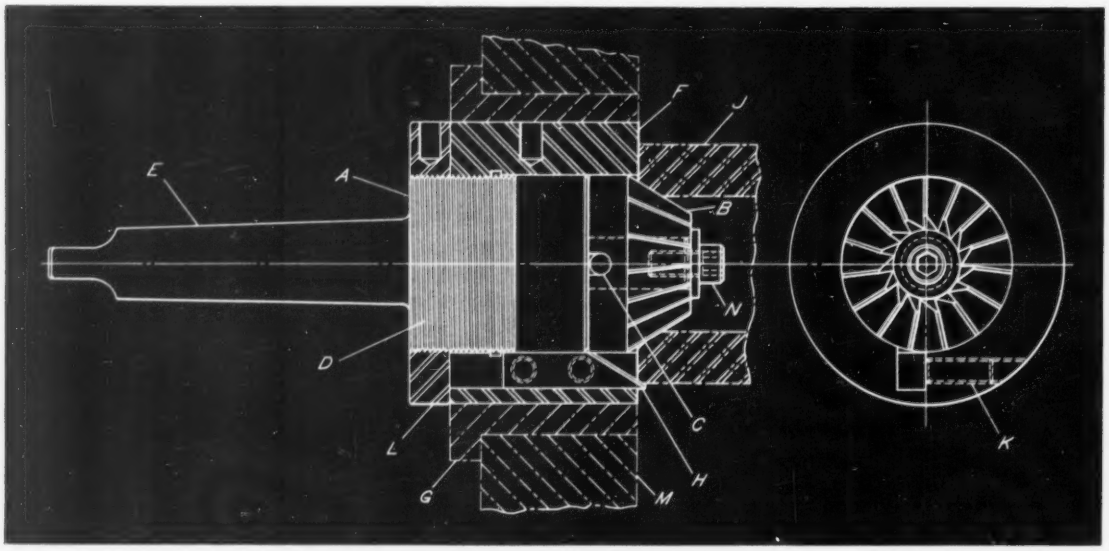


Fig. 2. Mandrel fixture which employs compressed air to facilitate bushing assembly is shown with adapter and bushing in place prior to the pressing operation



A combination countersinking cutter and chamfering tool for tubing

Special Cutter for Beveling and Chamfering Large Tubes

By Roger Isetts, Kenosha, Wis.

A countersinking tool for cutting an internal bevel in large tubes to enable them to be held on centers, and at the same time cutting a chamfer on the outside edge of the tubes, is here shown.

The cutter adapter *A* is made from SAE 4140 bar stock, turned down at one end to receive a special fifteen-fluted cutter *B*. A pin *C*, which passes through the cutter and the front shank of the adapter, transmits a positive drive to the cutter. A fine thread *D* is cut on the outside diameter of the adapter for adjustment purposes when it is desired to vary the bevel dimension. The outer end of the adapter is turned to a Morse taper to fit the machine spindle.

A hardened and ground sleeve *F* has three functions—as a stock stop, a bearing for a guide bushing *G*, and a holder for cutter *H* when it is desired to chamfer the outside diameter of the work *J*. Two set-screws *K* position the cutter. Locking collar *L* holds the adapter in the sleeve. Fixture *M* contains the guide bushing that accurately centers the tool and rigidly supports the cutter. Rapid removal of the cutter is accomplished by loosening the socket-head cap-screw *N*.

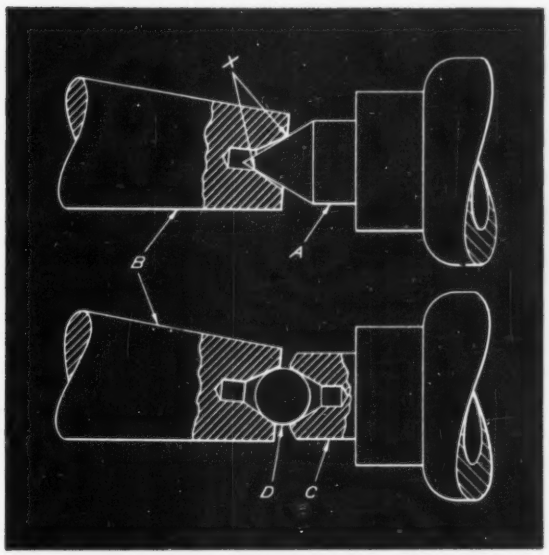
The Proper Way to Resharpen End-Mills

THE first requirement in resharpening end-mills is to make certain that all cutting edges are concentric with each other and with the shank of the tool, according to a recent bulletin issued by the National Twist Drill & Tool Co., Rochester, Mich. If end-mills can be mounted on centers for resharpening, this checking is comparatively easy. For end-mills that cannot be mounted on centers, an accurate chuck or holder must be used so that when in service uneven loading of the cutting edges will be avoided.

The amount of relief to be provided behind the cutting edges is sometimes varied with the material to be cut, but it is important that the amount of relief be varied with the diameter. The smaller the cutter diameter, the more relief necessary to avoid rubbing of the land heel on the work. While 4 or 5 degrees may provide sufficient relief for a 1-inch diameter end-mill, 10 or 12 degrees of relief may be desirable on a 1/8-inch diameter cutter. The relief must be sufficient not only to avoid heel rubbing but also to guard against too rapid widening of wear lands. However, too much relief will cause a cutter to hog in, chatter, and break.

Soft, fine-grit grinding wheels should be used for sharpening end-mills, and grinding should be performed in easy stages so as to avoid burning and discoloration of the cutting edges. Any burrs should be removed from small cutters by a fine hand stone before putting the cutters into use.

Ideas for Shop and Drafting-Room



When tailstock (*A*) is set off center, wear or breakage will occur at surfaces (*X*). By placing a ball (*D*) between the work and a special center (C), this condition is eliminated.

Ball Prevents Damage in Taper Turning

By Jose Sobkowiak

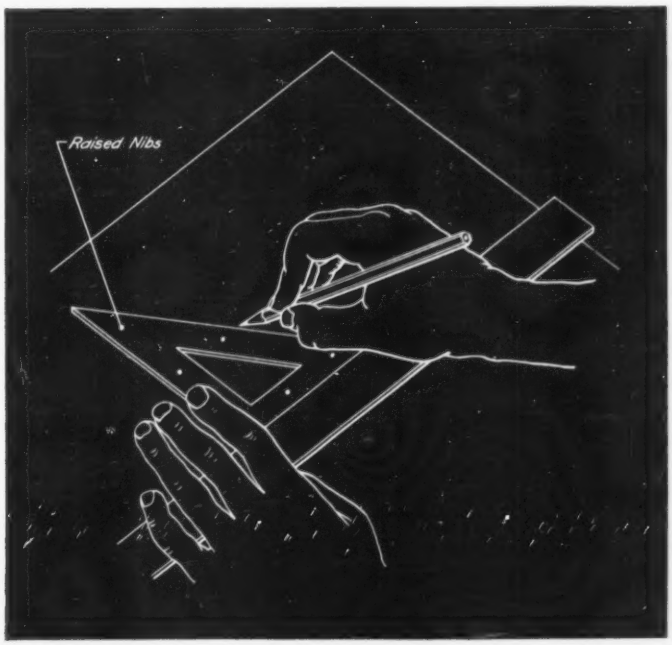
When the tailstock center is set out of alignment with the headstock center for taper-turning on a lathe not equipped with a taper attachment, there is the possibility that the center-holes in the ends of the work-piece will be damaged. This is illustrated at the top in the drawing, where tailstock center *A* bears against surfaces *X* in the work-piece *B*.

This condition can be avoided by using a special tailstock center *C*, as seen at the bottom, and placing a steel ball *D* between the center and the center-hole in the work-piece. The same arrangement should be employed for the headstock center.

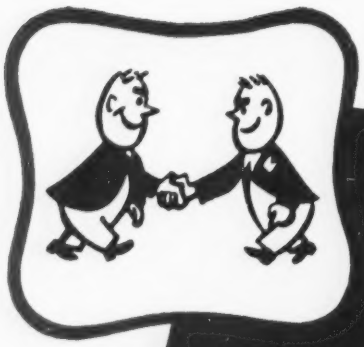
"Smearless" Triangle

By Sidney V. Worth

To prevent smearing of lines on a drawing, draftsmen can equip their triangles with small nibs that will raise the triangle about 1/64 inch above the drawing paper. The nibs will also permit the triangle to be moved over the paper more easily. To form the nibs, Plexiglas or Lucite can be dissolved in acetone and then applied to various points of one side of the triangle. When dry, the triangle can be turned over and other nibs applied to corresponding points on this side. Glue can also be used; or small holes can be drilled through the triangle and short lengths of wire inserted, then peened over.



Nibs on the triangle will help a draftsman to keep his drawing paper clean and will permit the triangle to be moved more easily



The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Mr. Sales Manager, How About Man Development?

THE president of a machinery building concern recently made the statement: "Our sales manager is better at planning sales than in developing sales engineers to carry out the plans." Pursuing this challenging thought, I questioned several sales engineers to find out what their sales managers did to hinder or help. As expected, some replies were flavored with censure, others with acclaim.

These rocks were hurled:

"All he seems to do is issue black and white orders. I'm in the dark when it comes to knowing why."

"As long as I get orders that stick, he just leaves me alone. Looks as if that's all that interests him. Some men may like his attitude, but I don't. I need new ideas to grow."

"My kick is that I don't have good tools to work with. I have made suggestions—might as well yell at a stone."

"Watch him start buzzing around to grab some of the glory when a big job is up; I like help all right, but I want to handle the job."

"I always have to ask for a raise. Just get another position lined up—then he takes notice."

But these bouquets were handed out:

"He's the most friendly, democratic fellow—has the humility that goes with wisdom. Always keeps his mouth shut after I tell him something in confidence. He's no mimeograph-letter guy. I'd do anything for him."

"Everything he tells me has the reason hitched up to it, so I know what it's all about. Besides, he's 'Johnny at the rat hole' when I make suggestions."

"He's always trying to give me more complete information to sell with—a better kit of tools."

"Always seems as if I have some goals to work for—greater recognition as well as better pay—when I deserve it."

"He follows my big jobs, asks how he can help. With the ball in my hands I don't hesitate to use him."

From these offhand remarks by sales engineers regarding their sales managers, we can establish a pattern which includes four main components of attitude and action.

1. Friendly and intimate contact with the individual salesman. This rules out the swivel-chair sales manager. It also rules out the one who spends all his time in the field, neglecting his office duties and horning in on important jobs to take credit deserved by the salesman. Friendly and intimate contact, on the other hand, places at a premium the importance of the sales engineer as an expert in command of customer and territory.

2. Firm and reasonable policies applying to all operations. The "why" of rules on procedure and decisions should be explained to the salesman to help in determining what is best for the customer, the company, and all sales personnel. No salesman should be left in the dark. If he is, how can he properly tailor his sales arguments to reach the desired goal?

3. Help in giving each salesman the best tools to work with. Countless salesmen have encountered a deaf ear to suggestions as to what they need in order to do an effective selling job and particularly in meeting customer demands peculiar to their respective territories. A real sales manager constantly places himself in the position of the salesman, looking through his eyes—first at prospects and customers individually and collectively; and second, at his company products, policies, and services.

4. Providing the incentives of encouragement—rewards that bestow distinction and monetary remuneration. We all get satisfaction from accomplishment. But when our attainments are

recognized by principals and associates, they really light up enthusiasm and loyalty.

It is a great temptation for any executive to depend on mechanized tools calculated to produce happy human relationships. But the successful sales manager must himself be a genuine and sincere human relations man. He cannot discount established methods of creating good will. One of the most neglected opportunities on the part of sales management is to know what goes on in the minds of salesmen. Many salesmen become discouraged, develop animosity or a grouch, and finally quit. Difficulties flourish in an atmosphere of doubt and ignorance. Human effort is wasted, morale is destroyed.

Every sales manager should periodically have an intimate, friendly talk with *each* salesman, detached from business problems. Such talks would provide a frank, honest opportunity for an interchange of ideas, an evaluation of the past, and a plan for personal development in the future.

* * *

Vacuum Employed to Shrink-Fit Large Tubes

In manufacturing augmenters for Convair airplanes, Solar Aircraft Co., San Diego, Calif., solved the problem of sliding metal tubes 12 inches in diameter over tubes 12 1/2 inches in diameter by the use of a vacuum. Two major components of the augmenters are a corrugated tube, about 124 inches long and 12 1/2 inches in diameter, and an outer shroud of the same length and approximately 12 inches in diameter. Both parts are made of Type 321 stainless steel—the corrugated tube being 0.050 inch thick and the outer tube 0.025 inch thick. The corrugated tube is fabricated to a larger diameter because the corrugations must fit tightly to the outer shroud along their entire length.

In the first method tried, the two components were placed in a tank 25 feet long filled with water. A pulley and winch arrangement was used to pull the outer shroud over the corrugated liner. Many units were spoiled, however, by galling and scratching.

Solar engineers then conceived the idea of evacuating the corrugated tube to shrink it so that the outer shell would slide on smoothly. A large wooden fixture was built to fit inside the corrugated tube and prevent it from collapsing, with slats to fit into each corrugation. Rubber-covered metal ends were fitted snugly over the wooden form and the corrugated stainless tube built up. A vacuum pump was attached to one end.

Vacuum shrinks the corrugated tube sufficiently to permit the shroud to be slipped over the tube, as seen in the illustration. Air is then allowed to re-enter the corrugated form. This expands the tube slightly, and additional air pressure is applied to increase the outer diameter of the corrugated tube to the inner diameter of the shroud. The tubes are finally welded along the lines where each corrugation touches the outer shroud. The completed augmenters have a large bellmouth at one end and a long nozzle at the other. Exhaust gas flowing through the augmenters induces cool air to flow across the engine. The gas-air mixture leaving the nozzle gives the airplane added forward thrust.

Vacuum is used to permit slipping outer shroud (12 inches in diameter) over corrugated tube (12 1/2 inches in diameter)

LATEST DEVELOPMENTS IN *Shop*

Giddings & Lewis Boring, Drilling, and Milling Machine with New Under-Arm

An under-arm having a continuous travel range of 78 inches is one of the outstanding features of the improved 570-FUAR floor type horizontal boring, drilling, and milling machine announced by the Giddings & Lewis Machine Tool Co., Dept. M, Fond du Lac, Wis. The under-arm is bolted to the bottom of the headstock and encased in a housing which lengthens the bearing surface of the headstock on the column by 14 inches. The increased rigidity provided by this additional bearing surface makes it possible to perform heavy cutting operations at greater distances from the face of the headstock. The long under-arm travel also has the advantage of permitting numerous operations to be performed without resetting the work.

The addition of a pivoted foot-actuated treadle clamp for securing the under-arm in position affords greater operating convenience. With this equipment, the under-arm can be clamped in position by simply pressing down on the left side of the treadle shown at *A*, Fig. 3. By depressing the opposite end of the treadle, the under-arm is released. The treadle can also be controlled by hand from the floor by inserting an ordinary hand-rod in the outer end of the treadle.

A telescopic sight *B* for reading

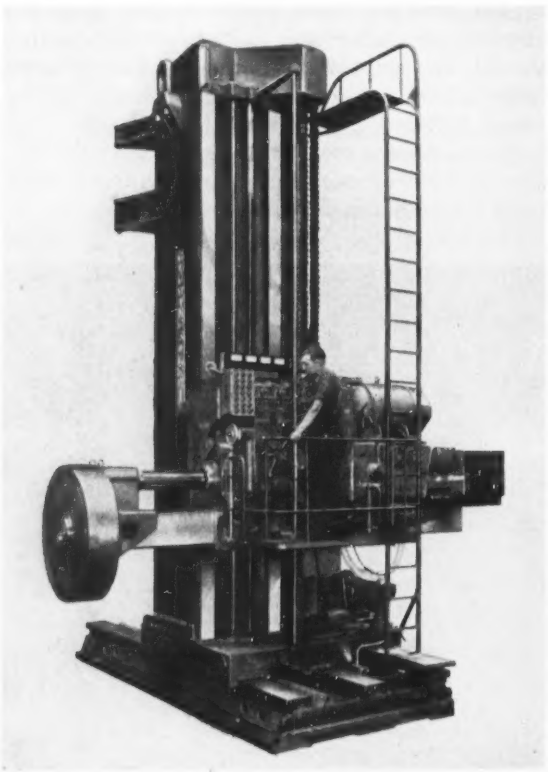


Fig. 1. Giddings & Lewis improved horizontal boring, drilling, and milling machine equipped with under-arm attached to headstock

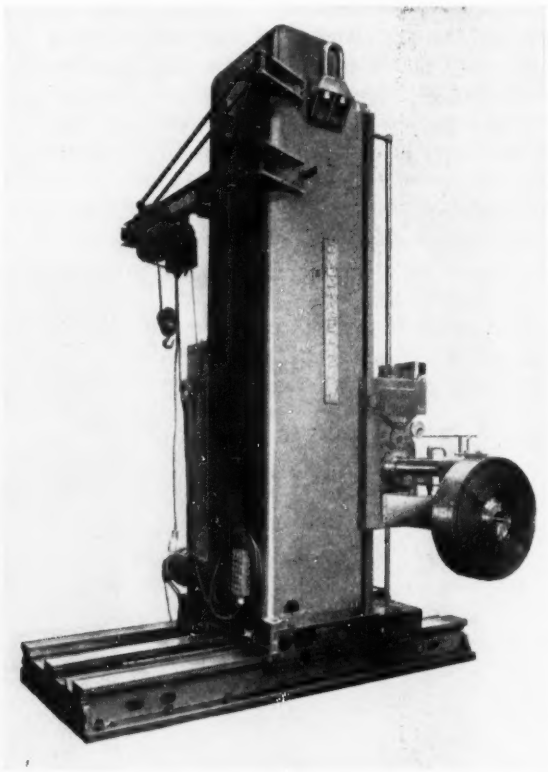


Fig. 2. Rear and side view of the G & L machine seen in Fig. 1, illustrating new crane and portable duplicate control station

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

scale and vernier settings on the machine runway or under-arm to 0.001 inch also saves many steps for the operator. Periscopic principles incorporated in this unit permit the operator to read either the ram or the column runway scale while manipulating the machine controls. The coated optical system of this equipment is easily focussed and assures a bright image of high definition.

Within easy reach, the feed control lever *C* for the under-arm permits the operator to hand- or power-feed the under-arm or spindle at either a 1 to 1 or a 6 to 1 ratio. Predetermined in-or-out travel of the under-arm can be set by means of a dial *D* containing the limit stops.

A 2-ton crane shown swung around to the rear of the column in Fig. 2 is now regular equipment on this machine. The crane provides for fast lifting and positioning of the under-arm attachments, and eliminates waiting for an overhead crane. Typical of the under-arm attachments served by the crane is an offset unit with a 90-degree angular milling attachment. This offset unit can be swiveled through a complete circle of 360 degrees. It extends the usefulness of the angular milling attachment, permitting it to be employed in machining many recessed surfaces which do not allow sufficient clearance for the angular milling attachment alone.

Many difficult jobs can be simplified by using the G & L continuous feed facing attachment in conjunction with the under-arm and spindle support. Other under-arm attachments that can be positioned by the crane are the new 46-inch faceplate drive and the clapper box type of shaping attachment. The former is designed to transmit greater horsepower at the slow speeds necessary for heavy boring on large diameters; the latter to machine keyways, slots, oil grooves, small pads, or similar surfaces which might otherwise call for repositioning the work-piece or setting up another machine.

Norton Improved Abrasive Cut-Off Wheel

The Norton Company, Dept. 6, Worcester, Mass., has announced an improved reinforced, resinoid, hub type cut-off wheel. This abrasive cut-off wheel known as the "BFR," replaces one with the same designation previously available.

Longer life, more uniform grinding action, and practically no tendency to fray or split at the face are features claimed for this improved wheel. It is available in Alundum 16, 24, 36, and 54 grits and Crystolon 16, 24, 36, and 54 grits in diameters of 7 and 9 inches and thicknesses of 1/8, 3/16, 1/4, and 3/8 inch. The hole size is 7/8 inch, the grade K and the marking—KBFR—X27.

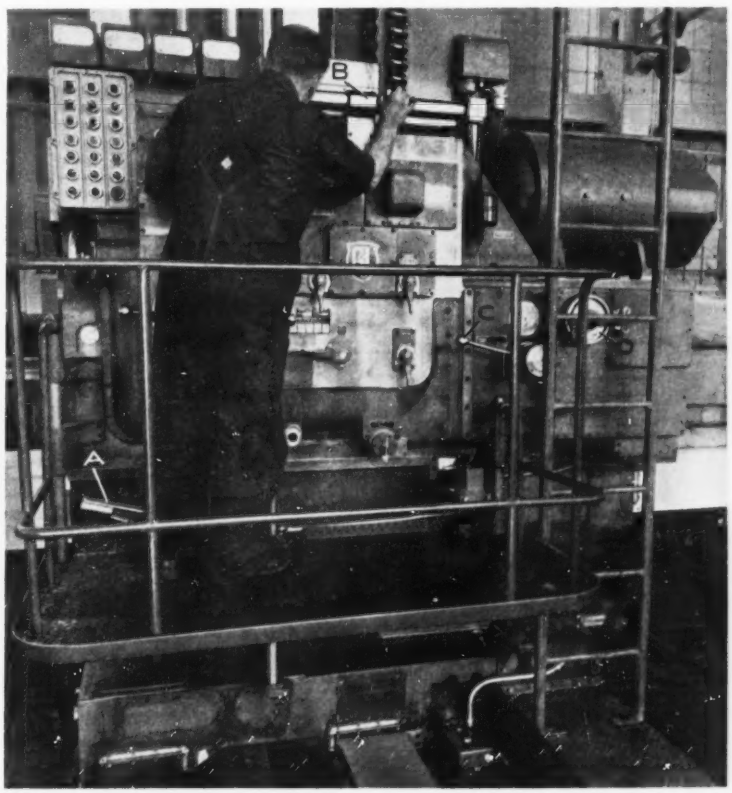


Fig. 3. View of operator's control platform on Giddings & Lewis machine

Fig. 1. Machine for welding capacitor cans developed by the Morton Mfg. Co.

Morton Production Welding Machines

The Morton Mfg. Co., Dept. M, Broadway and Hoyt, Muskegon Heights, Mich., recently developed two special production welding machines. The machine illustrated in Fig. 1 is designed to weld capacitor can seams. A twin-station set-up is used on this machine to permit unloading and loading in one station while work is being welded in the other station.

Constant-velocity welding over the entire butt seam is obtained by employing independent speed regulation at the corners of the work. Complete automatic control of the welding cycle includes rapid traverse of the welding torch carriage as it moves from one end of the work to the other. A special fluid and electrical rotary valves provide for continuous rotation of the welding torch and power ejection of the welded part. High unit clamping pressure is employed to insure proper contact of the material with the water-cooled copper back-up bars.

The special, fully automatic, four-head submerged-arc welding machine shown in Fig. 2 is de-

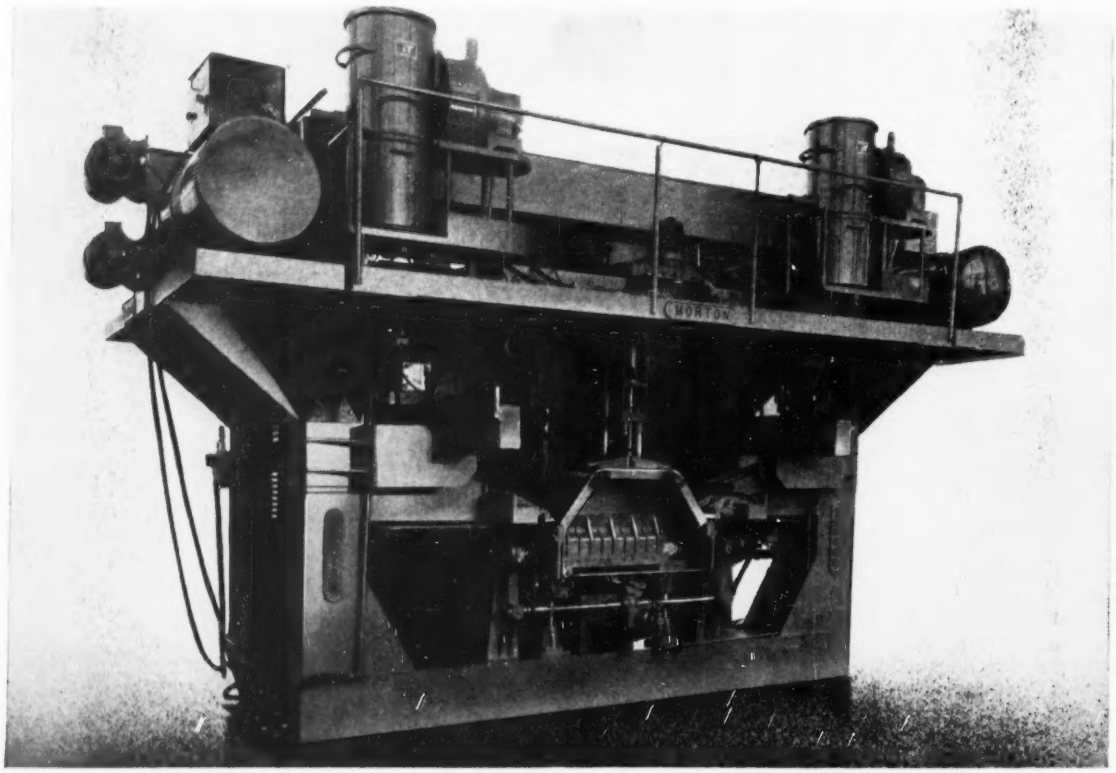


Fig. 2. Morton automatic machine designed specially for welding complete trailer bodies

signed for welding a complete trailer body. A sub-assembled platform consisting of three separate sheet-steel parts is carried by a power conveyor to positive stops on the welder. The two fenders are then put in place, as shown in the illustration. Simultaneous clamping of all parts then occurs, and the two operators start the welding cycle in which all four heads make overlapped welds.

The heads are interlocked and synchronized to operate without interference. Delivery and recovery of the flux are fully automatic. When the welding cycle is completed, all welding heads move to work clearance stations. The parts are then unclamped and the welded assembly is carried out of the machine by a power conveyor while new parts are being inserted for the next operation.

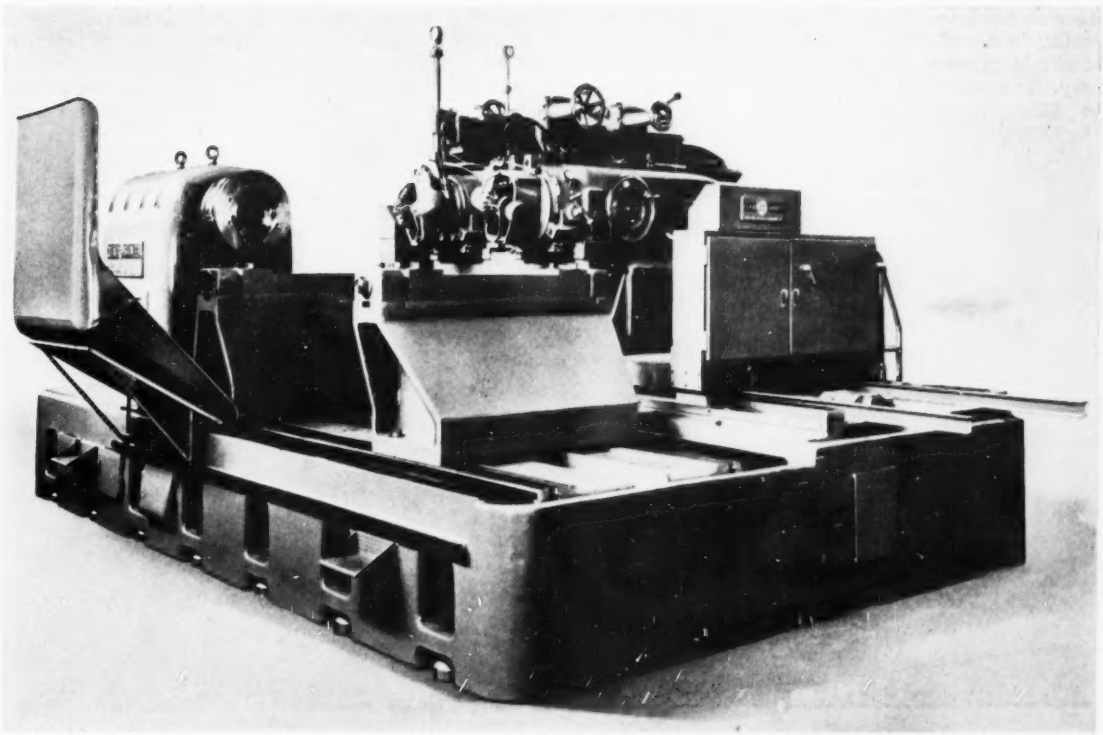
Improved Horizontal Shaving Machine for Large Precision Gears

An improved Model GCK-96 Red Ring precision gear shaving machine for spur, helical, and herringbone gears from 2 to 16 diametral pitch having pitch diameters of from 24 to 96 inches has been announced by the National Broach & Machine Co., Dept. M, 5600 St. Jean, Detroit 13, Mich. Improvements on this machine include two cutter-heads that speed up shaving operations on herringbone gears, rapid traverse feeds on both heads that reduce set-up time, and redesigned controls that facilitate operation. The machine is equipped with a flexible work driver and adjustable bearing pedestals, permitting large gears to be shaved by the rotary crossed axes principle while mounted on the journal bearings on which they are to be used.

The cast-iron machine bed is designed to support gear assemblies weighing up to 26,000 pounds. The work platform on which the operator stands to set up and run the machine rides on individual rails, thus avoiding deflections in the saddle ways. The platform is attached to the saddle through spring and rubber connectors that further isolate any effects of operator weight. A journal alignment checking bar is mounted in a slide in the saddle that supports the two cutter-heads. This hand-controlled bar can be operated from either side of the saddle for checking the alignment of the gear journal bearings in both the horizontal and vertical planes.

Indicators for setting the cutter-head to the correct crossed axis angle are provided in each cutter-head to facilitate entry of the cutter into mesh with the gear teeth. Duplicate push-button controls for all machine functions are provided in panels at the side of each cutter-slide. Hardened and ground steel ways support both the cutter-head slides and the saddle. A splash pan that rides on individual rollers on the machine base is provided. The pedestals that support the gear journal bearings are adjustable in all planes.

The work gear having been set up in the correct position on the machine and its shaft attached to the flexible work driver, the cutter is meshed with the gear at the crossed axis setting. Then the gear is rotated by a 10-H.P. motor drive that includes V-belts, a worm reduction, and speed change-gears. With the work thus driving the cutter, the saddle reciprocates the cutter back and forth across



Improved Red Ring horizontal precision gear shaving machine for spur, helical, and herringbone gears

the face of the gear. The cutter is manually fed to a depth that produces the desired tooth size on the work gear.

The machine will accommodate cutters up to 12 inches in diameter, and has a maximum shaving range of 111 inches. It is 240 inches long, 210 inches deep, 129 inches high, and weighs approximately 150,000 pounds. An integral coolant pumping system is included with the machine.

Heavy-Duty Electric Impact Hammer with Wide Range of Adjustment

Black & Webster, Inc., Dept. M, 445 Watertown St., Newton 58, Mass., is introducing a heavy-duty electric impact hammer designated the Model C "Electropunch." This bench model unit is capable of delivering impact blows that are adjustable from a few pounds to 10,000 pounds at rates up to 75 blows per minute. It is particularly adapted for such operations as heavy-duty staking, crimping, punching, forming, riveting, stamping, and marking.

The Electropunch operates on the electromagnetic principle, deriving its power from a specially designed solenoid. A selenium rectifier is used to transform alternating to direct current in order to obtain greater operating efficiency. The unit can be operated on 110-volt alternating current

Black & Webster's heavy-duty electric impact hammer

through a hand, foot, or automatic switch. It draws a current of 25 amperes only during the power stroke of the machine that takes 0.025 second.

The shut height can be adjusted from 1 1/4 to 6 3/4 inches. The tool hole is 5/8 inch in diameter and 1 inch in depth. The unit weighs 95 pounds, is 25 5/8 inches high (with head elevated), and has a power stroke of 2 inches. Work-table dimensions are 7 7/8 by 6 inches.

Tri-Clad Line of Motors Announced by the General Electric Co.

A new line of polyphase alternating-current motors has been announced by the Small Integral and Medium Induction Motor Departments of the General Electric Co., Dept. M, Schenectady 5, N. Y. These motors—designated Tri-Clad "55"—are built to the latest standard NEMA frame dimensions and embody new features developed to provide better protection for the motor, increased efficiency, and quieter operation.

With an average size reduction of 50 per cent by volume and 22 per cent less weight per horsepower in comparison with the previous Tri-Clad motors, these motors still retain rigid cast-iron construction. They have new insulation and ventilation systems and bearing assemblies. An outstanding feature of the insulation system is a polyester film which is said to be eight times as strong as any previously used material. This synthetic material—combined with Formex wire, an improved Glyptal varnish, and a silicon Drifilm dip—withstood accelerated life tests and salt spray tests to an exceptional degree.

The bearing assembly is tightly sealed and is lubricated by a grease which is said to last five times longer than any lubricant formerly used. A double-end ventilation system uniformly cools the

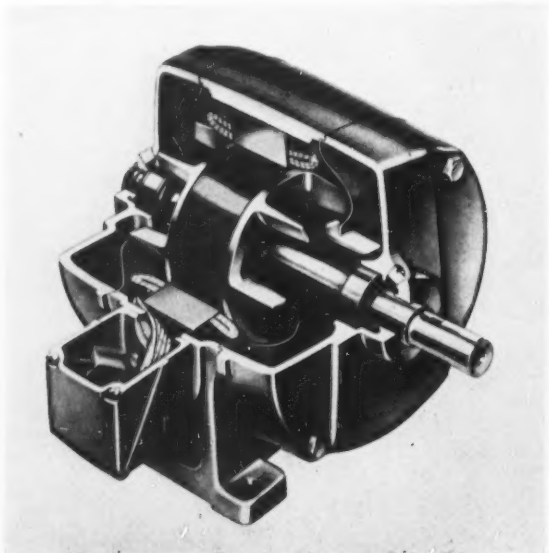


Fig. 1. Cut-away view of General Electric drip-proof Tri-Clad "55" motor

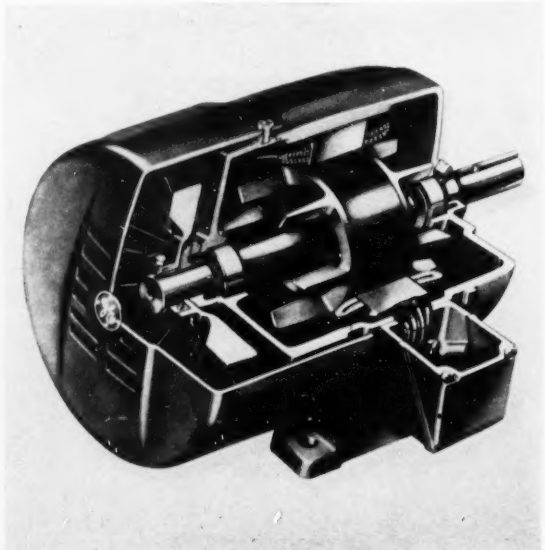


Fig. 2. Cut-away view of totally-enclosed fan-cooled Tri-Clad "55" motor

motor by drawing air in from beneath both end shields and through baffled air passages. The air is exhausted through louvers on the sides of the frame. Larger integrally cast rotor fans increase the cooling air flow through the motor and dissipate rotor heat. Protection has been increased by 60 per cent on the drip-proof enclosure through the new end-shield and frame design shown in Fig. 1.

Over-all sound levels have been reduced, the motor sound being changed to a frequency more pleasing to the human ear. It is claimed that the noise level of the new 10-H.P. motor tests as low as that of the former 2-H.P. model. All Tri-Clad motors must now pass a quality control sound test.

The totally enclosed fan-cooled motor shown in Fig. 2 also has been redesigned. Electrical parts are completely enclosed by tightly sealed cast-iron frame and end shields, a compression-fit lead seal, and a rotating labyrinth seal on the shaft. A "jet" ventilation system blankets the frame with cooling air.

Improved maintenance features include permanently numbered, non-wicking connection leads, a larger diagonally split conduit box, knock-off lugs on the end shields, and location of the combination nameplate-connection diagram directly over the box. Although size and weight have been materially reduced, the Tri-Clad "55" has a higher full-load speed rating and greater efficiency.

The motors will be available in the 182 and 184 frame sizes (1, 1 1/2, and 2 H.P. at 1800 R.P.M.), in horizontal drip-proof and totally-enclosed fan-cooled models, and in a complete line of gear-motors.

Fig. 1. Grinder with two opposed spindles equipped for finishing parallel sides of brake band

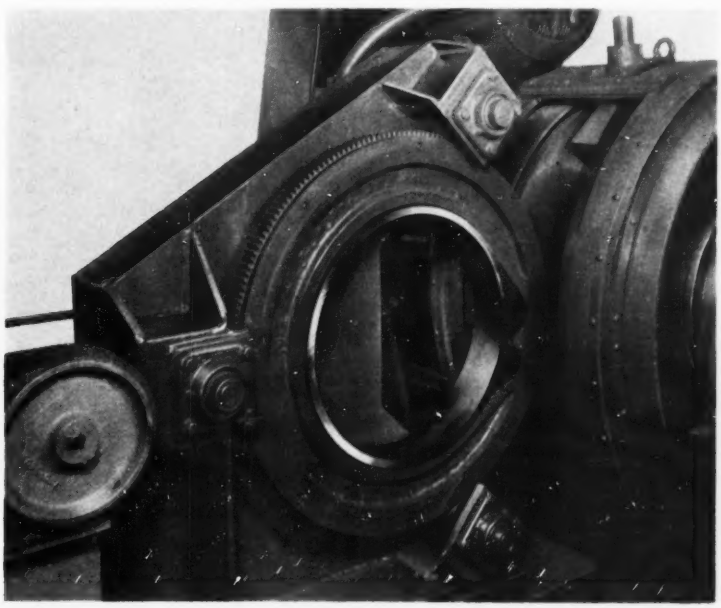


Fig. 2. Close-up view of large circular work-holder of machine shown in Fig. 1

Gardner Double-Spindle Grinder for Finishing Large Brake Bands

The equipment of a No. 125 double-spindle grinder recently built by the Gardner Machine Co., Dept. M, 414 Gardner St., Beloit, Wis., includes a hydraulic head-closing attachment, a hydraulically operated sliding work-table, a wet grinding system, and a circular type fixture for grinding the parallel sides of brake bands up to 30 inches in diameter. The opposed spindles of this machine are 3.937 inches in diameter in the bearings at the wheel collar end. Anti-friction bearings are used and provision is made to exclude dirt and grit from the bearing chambers. The spindles are driven through V-belts from motors mounted above them on hinged plates. The heads are hydraulically operated, control valves being mounted at front of machine.

The large circular fixture has gear teeth on its periphery and an opening of the correct size and shape to accommodate one brake band at a time while grinding the two parallel sides. The work-holder is mounted between two sprockets at the front and a single driven sprocket at the rear which provides for rotating the brake bands.

In grinding, the operator locates a part in the work-holder and then starts the rotating action. He then actuates the hydraulic feed, which carries the piece partially between the abrasive wheels where it will continue to rotate while the heads feed in hydraulically, removing stock from both sides of the brake band simultaneously. When the grinding operation is completed, the heads are opened and the fixture withdraws to the starting position for unloading. Two 40-H.P. 1800-R.P.M. motors provide the driving power for the unit.

The brake bands ground on the machine illustrated have an outside diameter of 16.2 inches, an inside diameter of 14 29/32 inches, and a thickness of 3 1/8 inches. Stock to a maximum depth of 0.020 inch is removed from each side of the brake bands. Parallelism of the opposite sides of the brake bands is held within tolerances of 0.003 to 0.004 inch. Production is at the rate of thirty to forty pieces per hour.

Cleveland-Munding Bench Radial Drill

A bench radial drill recently purchased from the Munding Machine Co., Glendale, Calif., by the Cleveland Tapping Machine Co., Dept. M, subsidiary of Automatic Steel Products, Inc., Canton 6, Ohio, is being introduced as the "Cleveland-Munding" bench radial drill.

This drill is designed to combine the convenience and accuracy of a sensitive drill, the range and capacity of a large drill, and the speed and flexibility of a radial drill. It is equipped with a column 3 3/8 inches in diameter, has an arm 24 inches long, and will drill holes up to 1/2 inch in steel.

The radial arm has a vertical travel of 25 inches on the column, and the head has a horizontal travel of 18 inches on the arm. The spindle has a travel of 6 1/8 inches and is equipped with a 1/3-, 1/2-, or 3/4-H.P. motor. Eight spindle speeds are available ranging from 160 to 3140 R.P.M.

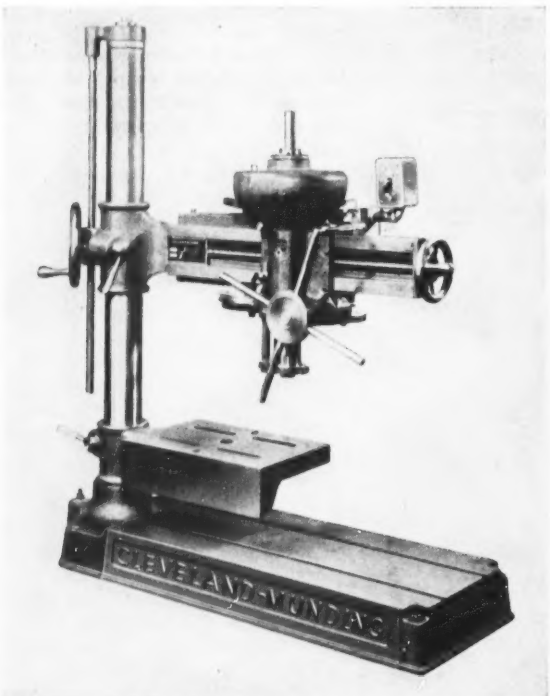
Stone High-Speed Cut-Off Machine

A Model M-35 cut-off machine has been developed by the Stone Machinery Co., Inc., Dept. M, 613 Fayette St., Manlius, N. Y., to meet the need for a small, low-cost unit adapted for a wide range of applications in metal-working plants. This machine is equipped with a 3 1/2-H.P. direct-drive geared-head motor that gives a spindle speed of 3200 R.P.M.

The machine uses a 12-inch abrasive wheel for cutting ferrous metals and a 12-inch steel saw blade for cutting non-ferrous metals. It will cut 1 1/2-inch solid ferrous bars, 2 1/2-inch O.D. pipe, and 2 1/2-inch structural members. The capacity for cutting non-ferrous solid materials is 2 1/2 inches, and tubing and extrusions, 3 inches. The machine requires a floor space of 27 by 30 inches, and weighs about 275 pounds.

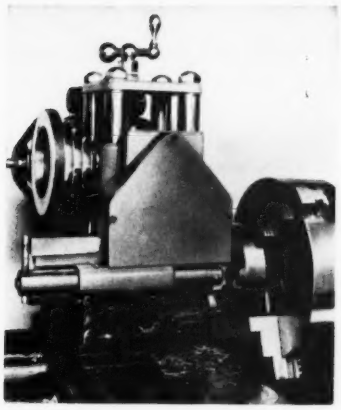
Versa-Mil Internal Keyseater, Slotter, and Shaper

The Versa-Mil Co., Dept. M, 33 W. 42 St., New York 36, N. Y., has added a portable internal keyseater, slotter, and shaper to its line of equipment. The tool can be mounted on a lathe carriage to cut internal keyways from 1/8 to 1 inch in width in holes of 1/2 inch diameter or larger in the same setup in which the hole is bored.



Cleveland-Munding bench radial drill announced by Cleveland Tapping Machine Co.

High-speed cut-off machine has been developed by the Stone Machinery Co., Inc.



Cutting a keyway on a lathe, using the Versa-Mil internal keyseater

The unit normally operates as a draw shaper, but where accessibility is limited, as in a blind keyway, a flip of a switch and a quick change of tool-holders adapts it for "push" shaping. Interchangeable tool-heads provide clapper action to relieve the tool bit on the return stroke. The stroke is adjustable from 0 to 5 inches in length. An oil reservoir provides automatic lubrication for every rotating and sliding surface. The dovetail slide that guides the stroke is adjusted for fit by a tapered gib.

Keyways 4 1/2 inches long have been cut in S A E 1020 steel using a 1/2-inch wide cutter bit and averaging 0.007 inch per stroke. Wider cuts are made by either moving the tool or changing to a wider tool bit after making a 1/2-inch cut to the required depth. The rigidity and close fits combine to produce cuts controlled in width to tolerances within 0.001 inch.

Van Norman Ram Type Milling Machines

The Van Norman Co., Dept. M, Springfield 7, Mass., has announced the development of four ram type milling machines designed to handle work requiring the highest degree of accuracy. These additions to the company's line consist of No. 24 light and medium machines and Nos. 28 and 38 medium machines. Various features have been incorporated in these machines to increase their range and to give them long life. They are especially applicable for use in tool-rooms, machine shops, production departments, experimental laboratories, and die and pattern shops. The adjustable cutter-head of these machines permits angular milling as well as conventional horizontal and vertical milling with one machine.

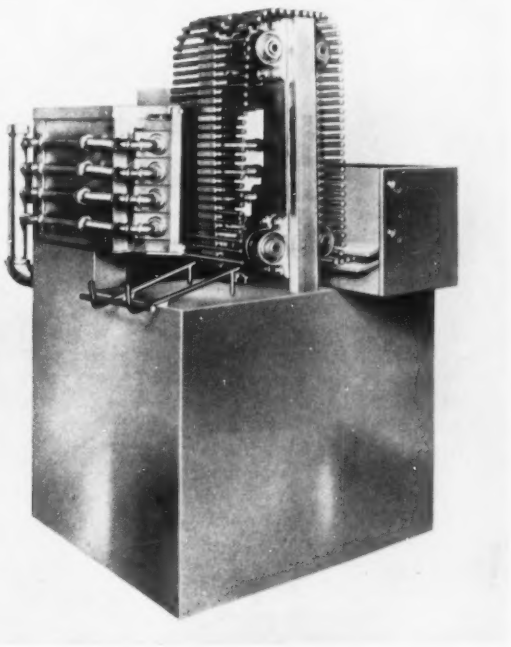
Among the new design features of these millers are heavier bases and columns; and more rugged table, saddle, and knee assemblies. Feed motors are mounted on the sides of the knees and new heavy rams have a greater movement over the column. Large handwheels with easily read dials facilitate accurate settings.

The cutter-heads have been redesigned for ruggedness as well as easy adjustment to the desired cutting position. A meter, mounted on the electrical control panel of each miller, shows the cutting load in per cent of maximum working capacity. This enables the operator to obtain full capacity from the millers without overloading them. The meter also shows when the cutter is becoming dull.

Furnace with Conveyor and Automatic Hopper Feed for Heating Ends of Rods

A furnace designed to heat a 4-inch end section of 1/2-inch rod to a temperature of 1900 degrees F. in fifty seconds, with an hourly production of 900 rods, is announced by Gas Appliance Service, Inc., Dept. M, 1211 Webster St., Chicago 14, Ill. Similarly, a 3/4-

Ram type milling machine of line announced by the Van Norman Co.



Conveyor and hopper-equipped furnace made by Gas Appliance Service, Inc.

Pratt & Whitney radial internal clearance comparator with maximum and minimum masters

inch rod can be heated to the same temperature in seventy-five seconds with an hourly production of 600 rods.

With conveyor and automatic hopper feed, this furnace is said to handle the stock sizes of rod from 1/4 inch to 1 1/2 inches in diameter, using a varying number of burners to satisfy the particular stock and production requirements. Any section can be heated on rods having over-all lengths of from 6 to 24 inches. This unit is adapted for use in heating rods that are to be upset, headed, swaged, locally hardened, or similarly worked.

Pratt & Whitney Radial Internal Clearance Comparator

An Electrolimit hand gage and an Electrolimit external comparator together with a DOU meter have been combined to form a radial internal clearance comparator by Pratt & Whitney, Division Niles-Bement-Pond Co., Dept. M, West Hartford 1, Conn. The comparator was originally designed to aid in the selective assembly of fitted parts, such as pistons and cylinders.

Checking the inside diameter of the cylinder is done with the Electrolimit hand gage, while the outside diameter of the piston is checked on the external comparator. Exact clearance between the two selected parts is indicated on the meter in the cabinet. Both hand gage and external gage are set to minimum and maximum masters. The meter has a total scale of 0.002 inch, with each graduation equal to 0.0001 inch.

Variable-Speed Drive for Logan Lathes

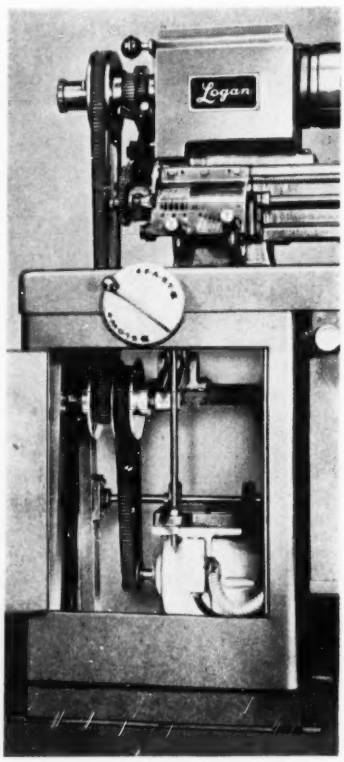
All models in the line of 12-inch lathes brought out by the Logan Engineering Co., Sales Division, Dept. M, 4901 W. Lawrence Ave., Chicago 30, Ill., and described in August, 1953, MACHINERY, are now available with either the standard Logan double V-belt drive or a new variable-speed transmission. The variable-speed drive permits a wider spindle speed range than the standard drive, with an infinite choice of speeds between the highest and lowest speeds. The speed range is from 38 to 295 R.P.M. with the back gears and from 250 to 1575 R.P.M. in direct drive. To obtain the correct speed, the lathe operator simply turns the variable-speed drive control handle while the lathe is running. To maintain optimum surface speeds on large-diameter facing work, for example, he adjusts the spindle speed as the cutter goes into the work. There is no need to stop the lathe or shift belts.

Twelve complete turns of the control handle cover the speed range. A brass chart mounted on the gear guard shows clearly marked settings for various speeds. The variable-speed pulleys are made of piston-alloy aluminum. Power is transmitted by one 38-inch and one 60-inch oilproof, heat-resisting "Vari-Speed" belt. Both of these belts are specially designed and can be easily replaced.

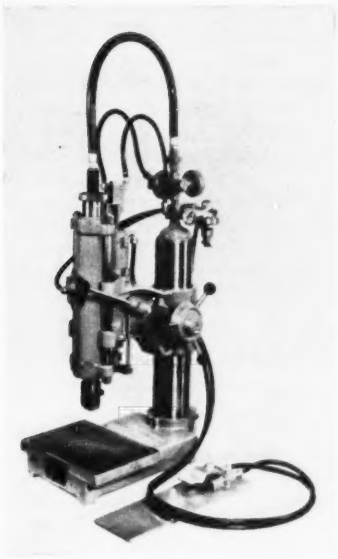
Tapping-Threading Fluid

A metal-cutting fluid called "Tapeze," said to have low rupture energy advantages in difficult tapping and threading operations, has been announced by the Metalloid Corporation, Dept. M, 514 N. Jefferson, Huntington, Ind. For such operations, it is claimed that less force is required to produce threads and that tap breakage is reduced when using the new metal cutting fluid. This tapping fluid is also said to make possible satisfactory tapping of stainless steel, titanium, and other types of steel generally considered to be non-machinable.

The tapping fluid can be applied straight, by hand, using a pressure type oil can or a paint brush. The material has been used with success on shaper operations for hogging die steel No. 1045 with 5/16-inch cuts, in this case the fluid being applied by brush ahead of the cut.



Logan variable-speed drive for lathes



Air-operated impact press built by the Heidrich-Nourse Co.

Pneumatic Impact Press

An impact press developed originally for impression marking of metal parts, but which has proved adaptable to various other kinds of work, is being manufactured by the Heidrich-Nourse Co., Dept. M, 631 E. Third St., Los Angeles 13, Calif. Uniformity of impact force on work-pieces that vary considerably in thickness, operator safety, and speeds up to 10,000 complete cycles per hour are outstanding features of this press. Operation is on the principle of a variable-stroke air hammer or piston-ram that moves within a closed cylinder and strikes a chuck projecting through the bottom of the cylinder. The length of the hammer stroke or travel inside the cylinder is adjusted by a large hand nut at the top, which changes the position of the inner cylinder head.

When the foot-valve pedal is pressed, the cylinder assembly with chuck and tool is brought into contact with the work by a hydraulic traverse mechanism, and the impact follows. The traverse and the impact stroke are in linked sequence, but each is adjusted independently. Clearance height of the tool above the work is set by moving the head assembly on the column.

On work of uniform thickness, the clearance between tool and work may be as little as 0.005 inch. This eliminates any danger of injury to the operator's hands. The machine will deliver an impact blow of any desired force from 30 to 30,000 pounds. On work that varies considerably in thickness, the vertical clearance may be set for the thickest piece, and within the traverse range of 2 1/4 inches the impact will be uniform on all pieces without making any further adjustment.

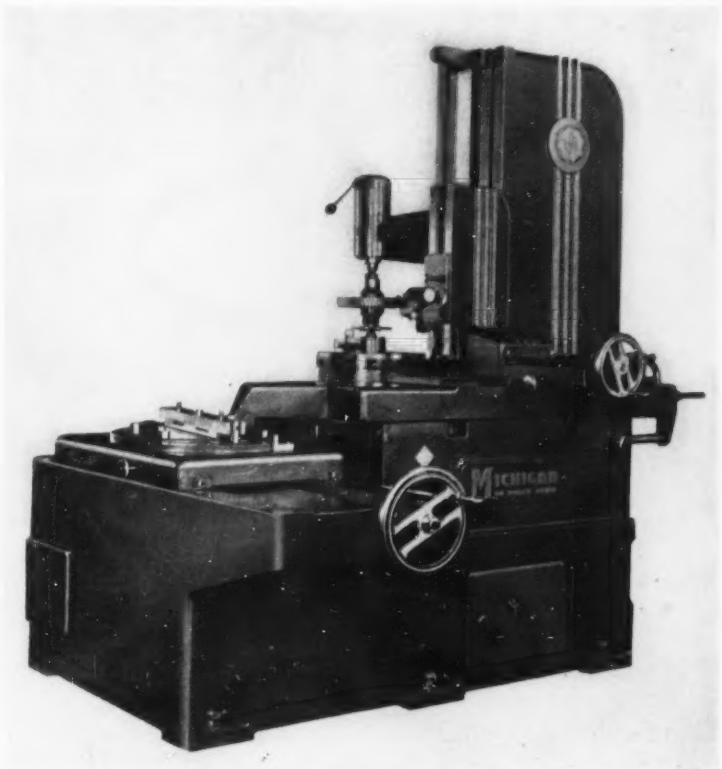
The press can be used on a wide range of one-shot or progressive impact operations, including impression marking, stamping, staking, swaging, upsetting, and riveting. With the addition of a time-dwell valve, it can be used for squeezing and heat branding without impact.

Michigan "Sine-Line" Involute Checker for Large Spur and Helical Gears

A "Sine-Line" involute checker capable of handling large spur or helical gears having pitch diameters up to 36 inches and a maximum spread between centers of 26 inches has been placed on the market by the Michigan Tool Co., Dept. M, 7171 E. McNichols Road, Detroit 12, Mich. In addition to checking the involute, this Model 1136 machine can be used to check tooth spacing. It is designed to facilitate rapid reading and charting. A single master disc, combined with a sine bar, establishes the proper ratio between the master disc and the base diameter of the gear being checked.

The first step in checking an involute profile is to set the sine bar and the indicator contact point in their correct positions relative to the base diameter of the gear to be checked. Movement of the sine-bar table moves the indicator contact point on a path that is tangent to the base circle of the gear. A simultaneous rotation of the gear by a positive steel tape drive causes the indicator contact point to trace a true involute. Any deviation from a true involute is read directly from the indicator.

A removable bracket attached to the indicator head holds fingers for checking the tooth spacing. Both spur and helical gears can be checked, checking of the helical gears being performed either in the normal or transverse plane.



"Sine-Line" involute checking machine for large spur and helical gears announced by the Michigan Tool Co.

When using this attachment to check the teeth in sequence, the indicator is retracted toward the operator and the gear is indexed to the next tooth.

Internal gears can also be checked on the machine by replacing the contact point with an L-shaped extension that supports a contact point in a radial position, the reverse of that occupied by the external contact point regularly used. Checking operations and settings are similar for both external and internal gears. The special adapters for internal gears are optional. Where automatic, accurate checking and a permanent record are required, the Michigan MTR recorder can be used.

Barnesdril Kleenall Combination Filters for Metal-Working Coolants

The Barnes Drill Co., Dept. M, 820 Chestnut St., Rockford, Ill., has added three models to its line of Kleenall combination fabric and magnetic filters. These filtering and separating machines are designed to remove non-magnetic as well as magnetic particles or contaminants from all types of liquids and cutting fluids automatically as they flow from the metal-working machine, and deliver the cleaned fluid to the storage tank for recirculation. In the combination fabric and magnetic filter shown in Fig. 1 the contaminated fluid flows directly into the channel around a magnetic drum where the magnetic material is attracted by and held to the drum until it is scraped off at the discharge position.

After exposure to the magnetic field, the coolant enters the filtering area, where it passes through a positive filtering fabric of specific porosity that removes non-magnetic contaminants to obtain the specified or required clarity, and returns the cleaned fluid to the machine for recirculation. With this equipment, the major contaminant load is removed magnetically and consumption of the fabric filtering material for removing the non-magnetic particles is held to a minimum. A roll of new fabric is fed automatically into the filtering area as it is required. When equipped with the most commonly used fabric the filtering capacity of this unit is 15 gallons of water-soluble coolant per minute. A similar but larger machine has a capacity for filtering 30 gallons of water-soluble oil coolant per minute, when equipped with the most commonly used filtering fabric.

The new large-capacity model filter shown in Fig. 2 has a flow capacity four times greater than the original unit. After exposure to the magnetic field from permanent magnets in the rotating drum, the contaminated coolant flows to the filtering area where it must pass through the filtering fabric of pre-determined porosity before returning to the storage reservoir for re-use. For cleaning coolant from non-magnetic metal-working operations, this unit is supplied without the magnetic drum.

Portable Power Hacksaw with Provision for Taking Angular Cuts

A portable power hacksaw called the "Hand-I-Hack" is being manufactured by the Lipe-Rollway Corporation, Dept. M, Emerson Ave., Syracuse 1, New York. This power hacksaw weighs only 50 pounds and will cut in any position. It has a capacity for cutting metal, plastic, or fiber stock up to 3 inches in diameter at any angle from 45 to 90 degrees. In operation, the saw blade draw-cuts and then raises from the cut on its return stroke. This feature has the advantage of permitting the saw to be operated vertically, horizontally, or even upside down. With its work vise clamped to a stanchion or a pipe, the hacksaw is self-supporting and ready to make repeated cuts that are

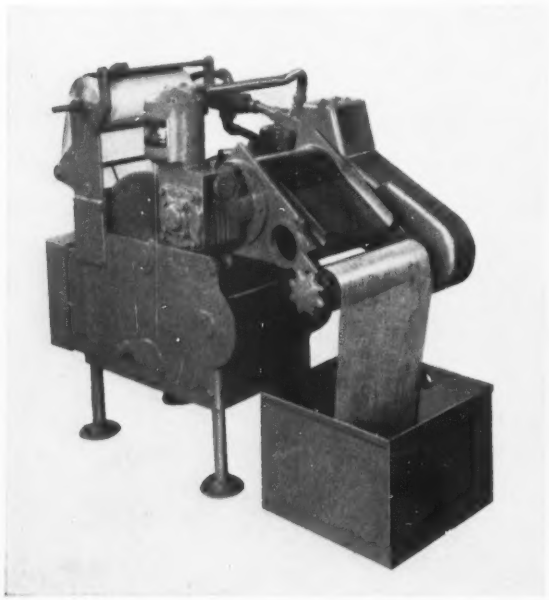
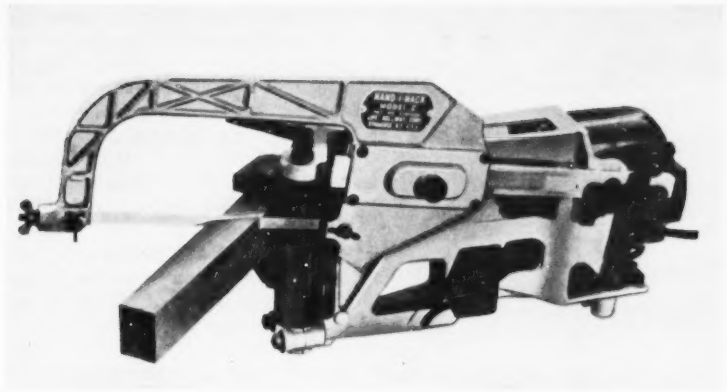


Fig. 1. Kleenall combination filter built by the Barnes Drill Co. for removing both magnetic and non-magnetic contaminants from coolants

Fig. 2. Large-capacity Kleenall magnetic and non-magnetic filter. Without magnetic drum, it cleans coolants from non-magnetic metal cutting work



"Hand-I-Hack" portable power hacksaw made by Lipe-Rollway Corporation

square within a tolerance of 0.010 inch.

The saw frame is made of lightweight cast-aluminum alloy. Sawing pressure is regulated entirely by a knurled screw on the side of this frame where adjustments in cutting pressure can be made for cutting thin tubing and other soft materials as well as for heavy cuts in solid steel.

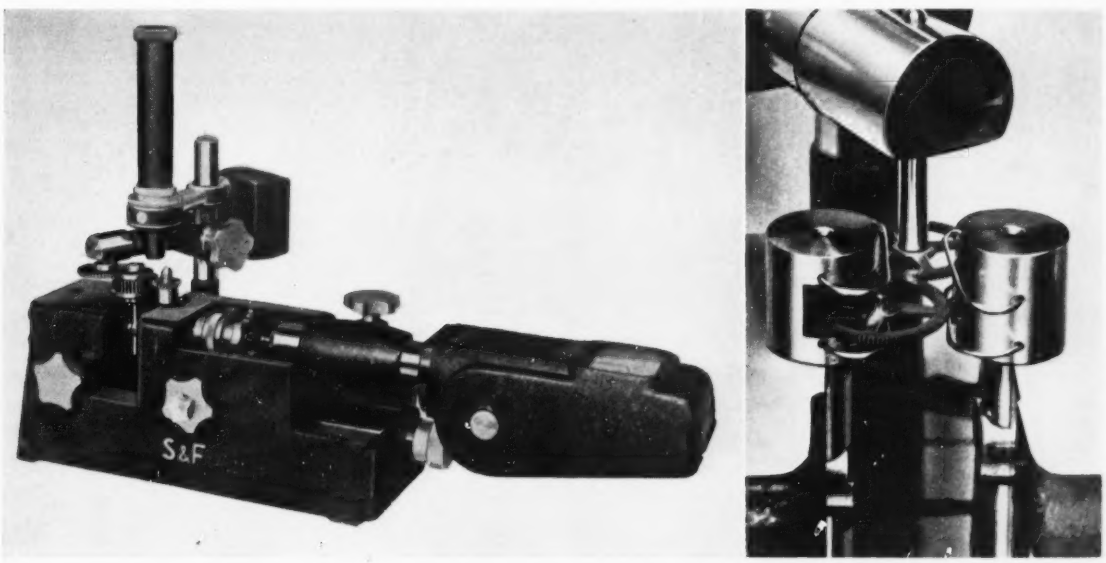
Operation of the saw is fully automatic. The saw blade has a speed of 115 strokes per minute, without load. The drive is provided by a steel worm and a bronze worm-gear, sealed in oil, which are powered by a 1/3-H.P. electric motor. The semi-steel machine type vise with sliding jaw is adjustable and calibrated for cutting angles up to 45 degrees.

Universal Gear Tester for Inspecting Fine Pitch Gears

A two-flank S & F universal gear tester for inspecting all types of fine-pitch gears, including those of the smallest dimensions, is being introduced in the United States by the Kurt Orban Co., Inc., Dept. M, 205 E. 42nd St., New York 17, N. Y. This tester can be used for the inspection of spur, bevel, and helical gears; worms and worm gears; flat and round racks; pinion shafts; finished and semi-finished gear assemblies; and extremely small gears and pinions such as used in instruments and dial gages. The gear being tested is rotated in mesh with a master gear, both flanks of the test gear teeth being in contact with those of the master, so that there is no backlash.

A dial indicator with a sensitivity of 0.0001 inch shows all the errors affecting the performance of a gear under operating conditions. These errors are indicated as a total composite error, which is made up of run-out (including lateral run-out or wobble) and tooth-to-tooth composite error. The total composite error is the result of the circular pitch error, tooth-thickness variation, and profile error. The addition of a "Graphotest" mechanical recording instrument provides a permanent graphic recording of errors, and simplifies the analysis of the total composite error into its components of run-out and tooth-to-tooth composite error. Magnifications of 100, 200, 250 or 400 times are available.

The tester is designed to provide both the sensitivity necessary for laboratory work and the ease of operation required for production testing. The smallest gear center distances can be obtained without additional clamping fixtures or angle-blocks. Provision can be made for either hand- or motor-driven rotation of the



(Left) Set-up for inspection of a spur gear in S & F two-flank universal gear tester introduced in this country by Kurt Orban Co., Inc. (Right) Set-up for testing very small gears with needle bearings for 0.012-inch diameter shaft in S & F tester. Gears with their pinions are held in small V-ways and clamped by spring type wires.

gears. For high-production testing a semi-automatic model can be furnished in which the only manual operation is the changing of the test gears. The entire test operation is then carried out on a predetermined cycle.

The instrument consists primarily of a bed, a slide that carries the test gear, and a measuring slide carrier for the measuring slide and master gear. Interchangeable bed slides are available for various types of gears. The bed slide for spur gears carries an additional V-block which permits testing gears with center distances up to 5 1/8 inches. The gears are illuminated from below, enabling the operator to see that they are meshing correctly and are free from shock or pressure.

Welding Positioner for Heavy Parts

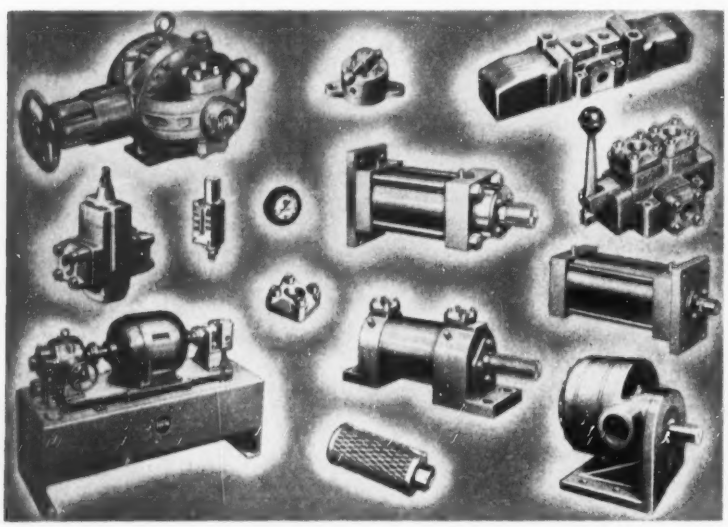
A Model P3000 welding positioner designed to solve the problem of holding heavy parts for welding operations and which is especially useful when automatic welding machines are employed, has been brought out by the Leader Welding & Mfg. Co., Dept. M, 2418 Sixth St., Berkeley 2, Calif. The power-operated tilting mechanism has self-locking gears and can be used to swing the table through an angle of 120 degrees from the horizontal position.

Leader power-driven positioner for use in welding heavy parts

The constant-torque table speed can be varied from 0 to 1 1/2 R.P.M. Higher speeds can be supplied if desired. Built-in dynamic braking equipment eliminates coasting or over-running when the current is off. The table is instantly reversible and can be rotated through an angle of 360 degrees, regardless of the tilted position. The table drive is powered by a spring-loaded worm-gear that eliminates backlash. Finger-tip control of both table rotation and tilt makes accurate positioning quick and easy.

H-P-M Complete Line of Hydraulic Components

The Hydraulic Power Division of The Hydraulic Press Mfg. Co., Dept. M, Mount Gilead, Ohio, has announced an extensive line of hydraulic cylinders, valves, pumps, motors, power units, and accessories. From catalogues covering this equipment, an engineer can lay out a hydraulic circuit to meet almost any requirement. For example, the H-P-M cylinder catalogue gives complete engineering data on over 800 basic models. Adjustable stroke cylinders are available with foot or center-line mountings.



Hydraulic components of complete line announced by the Hydraulic Power Division of the Hydraulic Press Mfg. Co.

The Model 300 series cylinders operate on an air pressure of 150 pounds per square inch or on oil-hydraulic service of 300 pounds per square inch. Another series for oil-hydraulic service is built for pressure up to 2000 and 3000 pounds per square inch. All models can be supplied for water-hydraulic service. The standard H-P-M line of hydraulic valves includes directional and functional valves to meet every circuit requirement. Each valve is available with optional body styles, types of control and methods of operation.

Directional valves are offered in threaded, flange, and gasket types for maximum pressures up to 3000 pounds per square inch. The four-way and two-way threaded valves range in size from 1/4 inch to 1 1/2 inches for a pressure up to 2000 pounds per square inch. There is a choice of manual, cam, foot, solenoid, oil and air pilot operation. Standard types of control include a new quadrant lever locking device with safety features for positive positioning. These valves are also available with flange connections for a pressure of 3000 pounds per square inch. There is an equally complete line of gasket-mounted valves in sizes from 1/2 inch to 4 inches for pressures of 2000 and 3000 pounds per square inch, and rotary pilot valves are included in the line. There are over 3175 models of valves.

Functional valves include relief, sequence, unloading, pressure reducing, counterbalancing, flow control, and check types. The valves with threaded connections are available in sizes from 1/4 inch to 1 1/2 inches for pressures up to 2000 pounds per square inch. Flanged valves range in size from 1/2 inch to 2 1/2 inches and are designed for pressures up to 3000 pounds per square inch, while gasket-mounted valves are made in sizes from 1/2 inch to 2 1/2 inches for pressures of 2000 to 3000 pounds per square inch.

The complete H-P-M line of fixed and variable displacement pumps and motors is suited for

innumerable hydraulic power applications for operating pressures up to 3000 pounds per square inch. Fixed displacement pumps and motors are available with plain, foot, flange, and motor mountings with capacities from 1 to 120 gallons per minute at a pressure of 1000 pounds per square inch. Variable-displacement pumps and motors are of the radial piston type with capacities ranging from 1 to 185 gallons per minute for 3000 pounds per square inch pressure service. Pump control equipment is also available. Reservoir capacities range from 7 to 200 gallons. Filters, gages, pressure switches, welding flanges, heat exchangers, slip joints, and other equipment are available for almost every circuit design requirement.

Westinghouse Direct-Current Arc Welder

Reductions in size and weight, easier maintenance, and greater operator convenience are advantages claimed for a new direct-current arc welder brought out by the Westinghouse Electric Corporation, Dept. M, Box 2278, Pittsburgh 30, Pa. This welder consists essentially of two parts: a three-phase, full-wave selenium rectifier and a "Transactor" unit. The Transactor unit, which is essentially a combination three-phase transformer and movable core reactor, has two three-phase laminated cores. One is a fixed core on which the primary and secondary coils are wound. The other is divided into two parts—a stationary and a movable core. The legs of the movable core are linked by the common secondary and reactor winding.

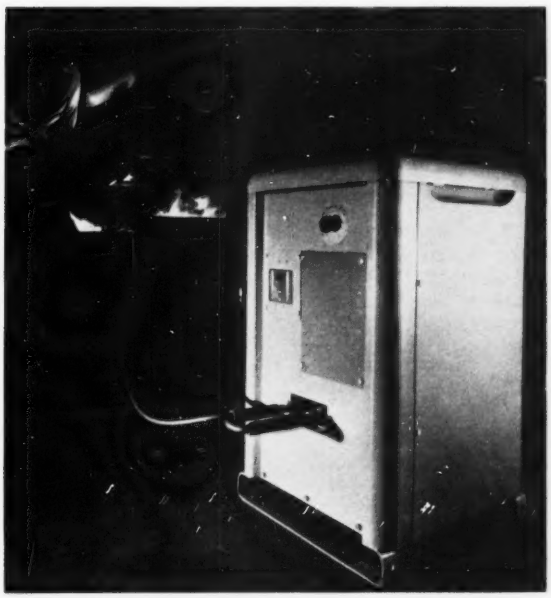
Current is controlled by means of a hand crank on top of the welder, which adjusts the movable core section in relation to the Transactor unit coils. This is said to be the first weld unit to have coils of aluminum. The coils are designed to produce operating characteristics equal to copper coils and to have the advantages of conserving critical copper and reducing coil weight by one-half.

Axial-flow ventilation, with the fan located in the top of the unit and the air intake at the bottom, permits incoming air to flow vertically through the welder, resulting in efficient cooling with a small-size fan and motor. Overload guards protect the welder from damage when it is operated on an excessive duty cycle or without the ventilating fan. When the coils of the Transactor unit return to a safe temperature, the circuit breaker can be reset and closed manually. There is an arc drive control for work requiring the use of a short arc.

Although this welder is built in three standard sizes with ratings of 200, 300, and 400 amperes, duplex models are available in 300/600- and 400/800-ampere ratings. These models consist of two smaller units mounted on a common bedplate and enclosed in a single case. Duplex models can be used as a single unit or as two separate units.

Sheffield Precisionaire Gaging Equipment for Crankshafts, Jet Blades, and Automotive Piston Pins

Accurate gaging of forty-three dimensions and conditions on an automobile crankshaft is accomplished quickly on the Precisionaire multiple gaging machine shown in Fig. 1. This equipment, just announced by the Sheffield Corporation, Dept. M, Dayton 1, Ohio, enables a comparatively unskilled operator to thoroughly analyze the most critical dimensions on a crankshaft and tell which are acceptable, over-size, or under-size simply by viewing the float positions in the thirty-six-column Precisionaire unit. The "Airechart," or float graph across the face of the glass columns, shows at a glance whether each dimension is within its required tolerance.



Westinghouse selenium rectifier direct-current arc welder of improved design

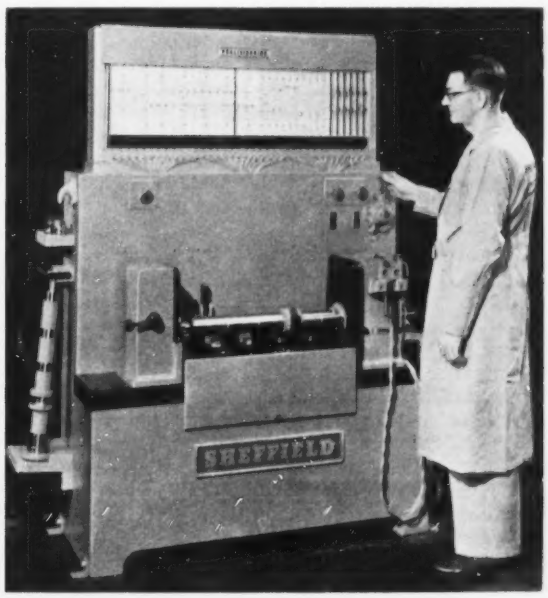


Fig. 1. Precisionaire crankshaft gaging machine built by Sheffield Corporation

Fig. 2. Precisionaire gage for checking jet blades

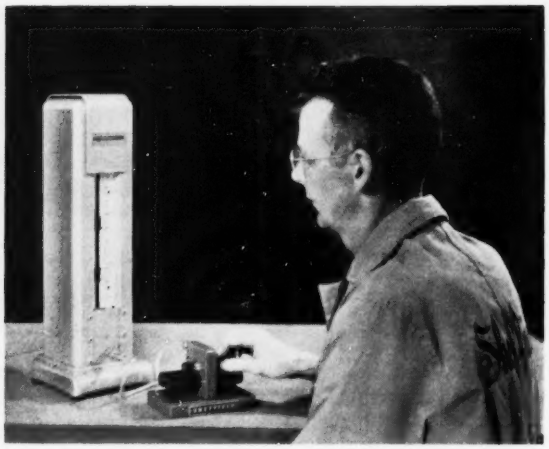


Fig. 3. Sheffield gaging equipment for piston pins

The gage is used to check five main bearing diameters at three places each, for taper, hourglass, out-of-round, and size; total indicator run-out of Nos. 2, 3, and 4 main bearings with the end main bearings; pulley fit diameter; thrust bearing width; oil-seal diameter; thrust face; flywheel pilot diameter; concentricity of the flywheel pilot diameter; pilot-hole diameter; concentricity of the pilot-hole diameter; flange face; stroke radius of each of the four pin throws; location of keyway to No. 1 pin bearing; radii of six counterweights; dimension of the thrust face to oil-seal location; and the diameter in three places and the high fillet of the four crankpin bearings.

The gage seen in Fig. 2 for checking simultaneously the thickness dimensions of the first and third serrations on the root form of the dovetail section of jet blades is another recent Sheffield development built for rugged everyday use at the production line. This gage consists of two pairs of measuring wires that are connected to two yoke reed-mounted actuated mechanisms which, in turn, actuate two Plunjet gaging cartridges. These gage points are floated both horizontally and vertically to eliminate the location tolerance of the root form in reference to the matrix holding fixture.

The blade, still incased in the holding matrix, is placed on guide rails and pushed into the gaging position so that the measuring wires contact the serrations of the root form which can be gaged along their entire length. The positions of the floats in the two-column Precisionaire instrument show whether or not the thicknesses of the root serrations are within the required tolerance. This gage has an amplification of 2000 to 1, so that a thickness variation of only 0.001 inch moves the float 2 inches in the glass column. This permits quick reading of tolerances higher than 0.000050 inch.

Rapid inspection of cylindrical parts, such as automotive piston pins for outside diameter, clover leaf, and taper, is being done on a new type Sheffield air gage shown in Fig. 3. Two cylindrical steel guide rails on each side of the air ring can be revolved when the sliding surfaces are worn, thus extending the life of the gage.

With this gage, the operator lays the pin on the two steel cylindrical guide rails and pushes it through the air ring. Instantly, the position of the float in the Precisionaire column indicates whether or not the pin is within its dimensional tolerance. To check clover leaf, the pin is revolved.

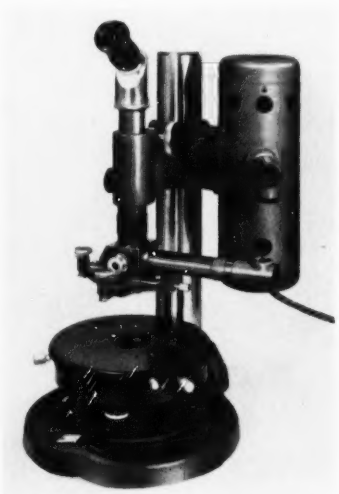
This air ring has three open type air jets equally spaced 120 degrees apart. When connected to a Precisionaire having a 10,000 to 1 amplification, a variation in diameter of 0.0003 inch will cause the float to move 3 inches in the Precisionaire column. Even a variation of as little as 0.000050 inch moves the float 1/2 inch.

CEJ Multiple Interference Microscope

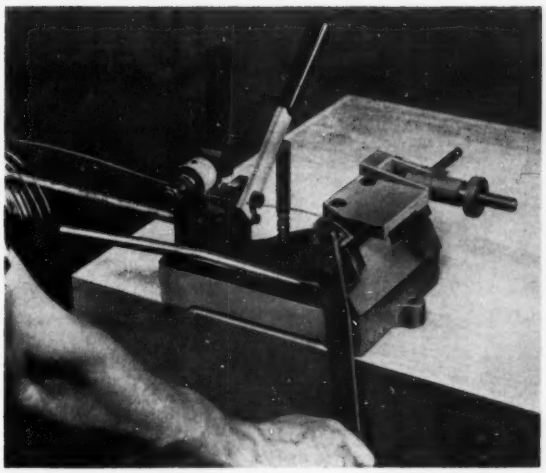
The C. E. Johansson Gage Co., Dept. M, 10641 Haggerty Ave., Dearborn, Mich., has developed the CEJ multiple interference microscope. A measuring accuracy as high as 0.04 micro-inch is obtainable with this instrument. The fringes of conventional interferometers are replaced by lines, constituting profile curves and contours, reproducing different surface shapes.

The upper limit of the measuring range is about 100 micro-inches. In addition, the multiple interference microscope makes the measuring range of 0.04 to 4 micro-inches (usually investigated with the aid of the electron microscope) available for several technical applications.

A 110-volt alternating-current mercury or sodium lamp is used as a light source. To facilitate measuring, the microscope is provided with an easily read revolving ocular type scale.



CEJ multiple interference microscope



Spring winding machine designed especially for short-run production jobs made by the O'Neil-Irwin Mfg. Co.

Power-belt grinders for burring and polishing inside of castings brought out by the United Machine Tool Co.

Di-Acro Spring Winder

The O'Neil-Irwin Mfg. Co., Dept. M, 559 Eighth Ave., Lake City, Minn., has marketed a new spring winding machine that requires no training or special skill for its operation. This spring winder is a self-contained unit with a special cut-off lever incorporated in its design. It can be used to form individual springs, or to relieve automatic machines on short-run production jobs.

The spring winder is ready for operation when mounted on a bench or in a vise. Any gage wire up to 1/8 inch in diameter, can be wound into extension, compression, torsion, or flat springs. Round, flat, square, or rectangular stock can be formed into springs of any length. A unique tension clamp mechanism is said to facilitate the winding of duplicate springs so that they have the same load capacity. Use of a special cam-lock device provides for quick gripping of the wire to be wound.

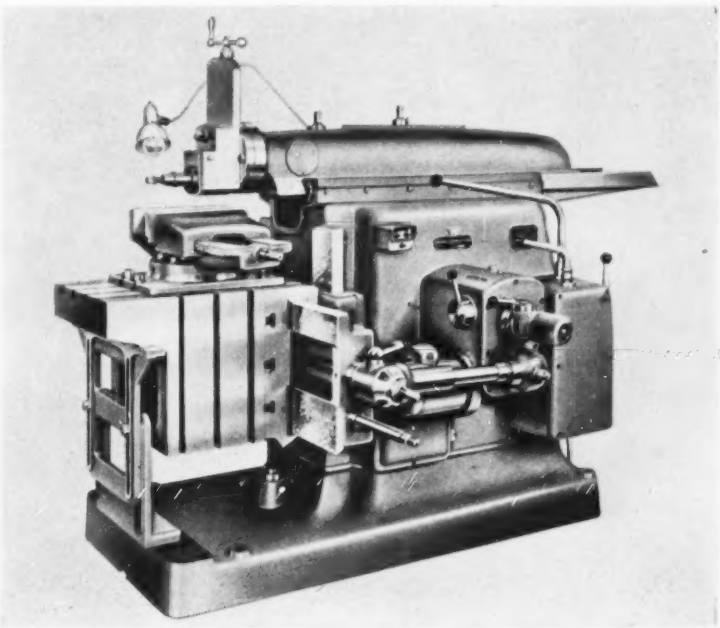
Burring Machine Designed for Work inside Castings

A power-belt grinder designed to deburr, grind, and polish the inside as well as the outside surfaces of castings and other metal or non-metallic parts is being brought out in bench and portable models by the United Machine Tool Co., Dept. M, 1909 Clyde Park Ave., S.W., Grand Rapids, Mich. All models are equipped with an automatic belt tightener and sealed bearing idler pulley. The grinder is designed for both flat and contour polishing.

Bench models are available with a 1/3-H.P. 110-volt motor in the single horizontal arm type and with a 1/2-H.P. motor in single horizontal arm, double horizontal arm, double vertical arm, or vertical and horizontal arm types which are adjustable clockwise to twelve operating positions. All bench models use 42-inch by 1-inch belts with commercially available abrasives and will work in holes 1 3/4 inches in diameter or larger. Belts 12 inches long by 1 inch wide can be had in many abrasives for the hand grinder attachments.

VMA Plain and Universal Shapers

Plain and universal VMA shapers are now being distributed in this country by the Austin Industrial Corporation, Dept. M, 76 Mamaroneck Ave., Box 430, White Plains, N. Y. These shapers are built in utility and heavy-duty models. The utility shapers are



VMA shaper introduced in this country by the Austin Industrial Corporation

manufactured in three sizes having 14-, 18-, or 22-inch strokes and in a plain type with swiveling table or tilting table top available as extras. They have six ram speeds and four power table feeds. Automatic vertical feed to the toolpost is also available on the 18- and 22-inch machines.

The heavy-duty shapers are available with 18-, 22-, or 26-inch strokes and with plain or universal tables. These machines have eight ram speeds and ten table feeds. A separate motor is provided for horizontal table power rapid traverse with a built-in safety device to prevent its operation unless the ram is stationary. A centralized lubrication system insures adequate lubrication of all moving parts. Available accessories include a keyway cutting attachment, automatic vertical toolpost feed, and automatic tool lifter. Both shapers are equipped throughout with anti-friction bearings and hardened and shaved gears.

Heavy-Duty Cut-Off Saw

Henry H. Wise Co., Dept. M, 945 Wilshire Blvd., Los Angeles 17, Calif., has marketed an all-purpose, heavy-duty, cut-off saw for cutting bars and shapes by chop-stroke operation. The unit is also adapted to gate and riser cutting by locking the cutting head and attaching the foundry bed. The saws are equipped by 7 1/2- and 15-H.P. motors to permit use of large-diameter cut-off wheels. Other features include large throat room, a new safety guard, and a heavy-duty foot-operated V-jaw vise.

Reuland Right-Angle "Motoreducer"

The Reuland Electric Co., Dept. M, Alhambra, Calif., has brought out a right-angle "Motoreducer" designed to convert a motor's high speed into a low-speed, high-torque output. The right-angle, worm-gear feature of this unit permits mounting on the floor, ceiling, or walls.

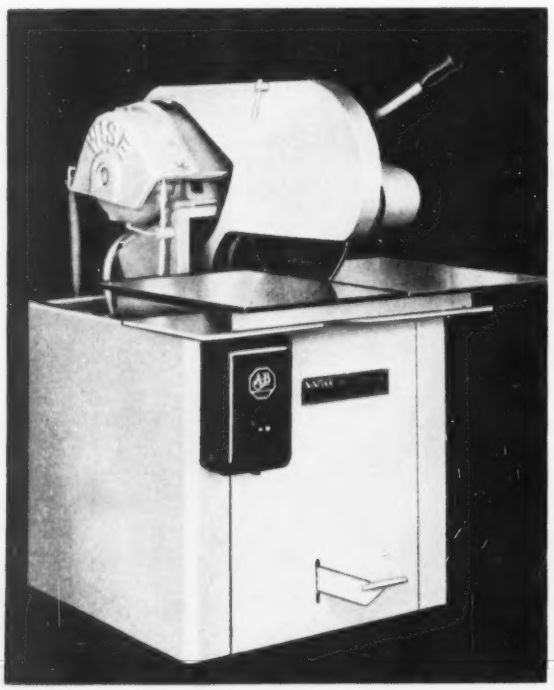
As many as three output shafts can be used. This includes one high-speed take-off shaft directly from the motor shaft, and either one or two low-speed take-off shafts from the speed reducer. The motor can be supplied in squirrel-cage, slip-ring, multiple-speed, and fluid-shaft types.

All units are also available with Reuland through-shaft, automatic magnetic brakes. These "Motoreducers" are available in sizes of 1/2, 3/4, 1, and 1 1/2 H.P., and can be furnished with speeds as low as 18, 24, 36, and 58 R.P.M., respectively.

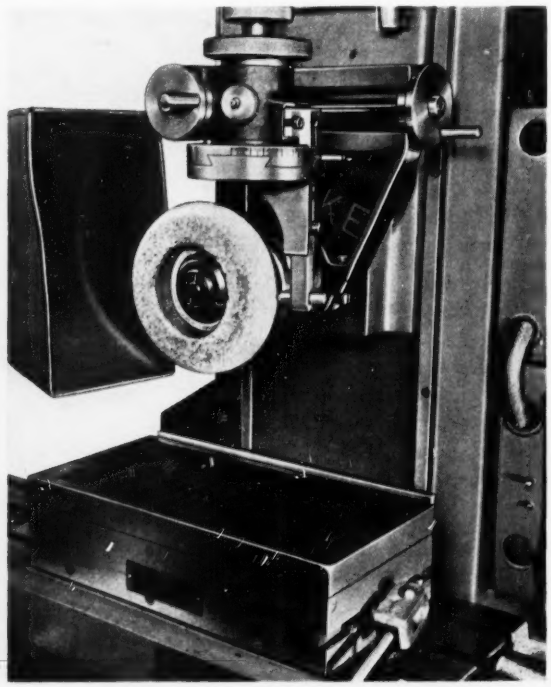
Fluid-shaft "Motoreducer" made by the Reuland Electric Co.

Radius Wheel Dresser

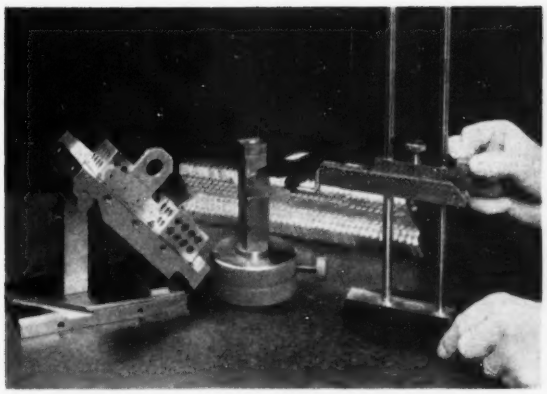
A radius tangent wheel dresser brought out by the Spike Mfg. Co., Dept. M, 24609 Middlebelt Road, Farmington, Mich., incorporates a principle in wheel dressing that eliminates set-up time for redressing. The dresser is mounted on the spindle, allowing the operator to dress the wheel to desired radii without removing work from the chuck. It can be used on the No. 2 surface grinder for dressing high-speed steel and carbide form tools.



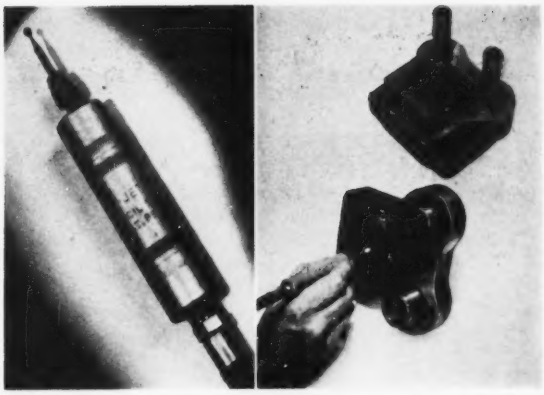
Heavy-duty cut-off saw announced by Henry H. Wise Co.



Radius tangent wheel dresser made by the Spike Mfg. Co.



An indicator height gage and an inspection block made by Tietzmann Tool Corporation



Pencil type high-speed grinder being manufactured by Nu-Jett Products

Indicator Height Gage and Adjustable Inspection Block

An indicator height gage and an adjustable inspection block designed for accurate inspection and lay-out work have been developed by the Tietzmann Tool Corporation, Dept. M, Englewood, Ohio. The indicator height gage, set to master parts or standard gage-blocks, can be quickly adjusted to the approximate height and locked in place. Final adjustments can then be made to millionths of an inch, using one hand as shown in the illustration.

The indicator assembly travels freely on two vertical rods and is locked to both rods by turning a knurled thumb-nut.

The adjustable inspection block, also shown in use, reduces inspection time by eliminating trial-and-error readings of the height gage. It is adjustable vertically in millionths of an inch through a range of 0.250 inch. The anvil is raised or lowered through a micrometer screw.

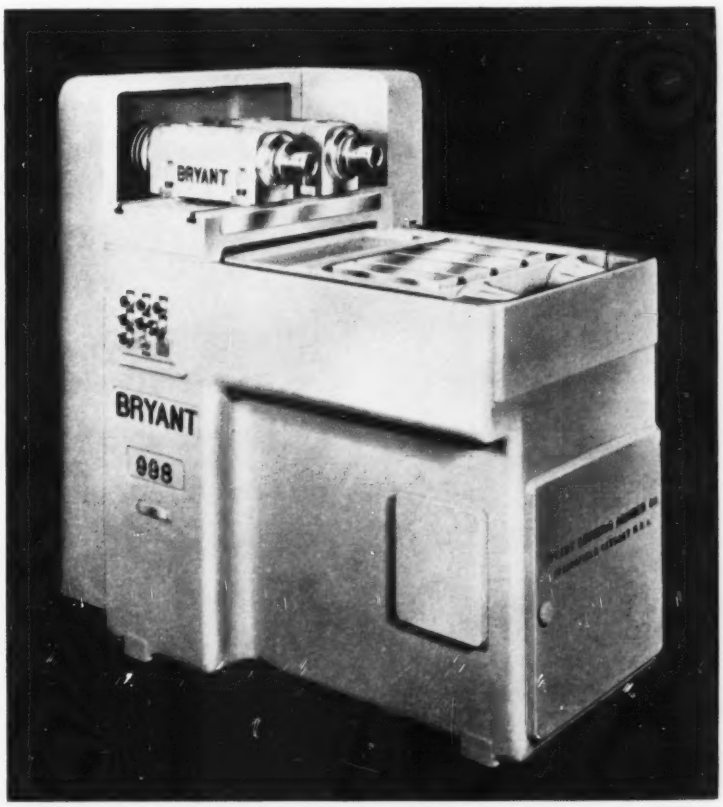
Pencil Type High-Speed Grinder

A pencil type grinder, said to be the smallest and lightest on the market, is now being made by Nu-Jett Products, Dept. M, 1335 Michigan Ave., N.E., Grand Rapids, Mich. This air-driven grinder weighs 4 ounces, develops speeds up to 110,000 R.P.M., and operates on air pressures of 50 pounds per square inch or more. It is particularly adapted for use in removing carbide burrs, and has been found useful in such operations as diemaking, wood carving, fine etching, polishing, and finishing. Because of its speed, it can be used to obtain a mirror finish on metal. Exhaust air from the front end of the grinder serves to blow all the dust away from the area of the work.

Bryant Precision Boring Machine

The Bryant Chucking Grinder Co., Dept. M, Springfield, Vt., is introducing a 998 boring machine developed for precision boring and drilling, straight or contour turning and boring, facing, and grooving. This machine is especially adapted for use where a fine finish and high production are desired. It can be tooled either as a single-purpose machine for quantity production or for handling miscellaneous work in small lots.

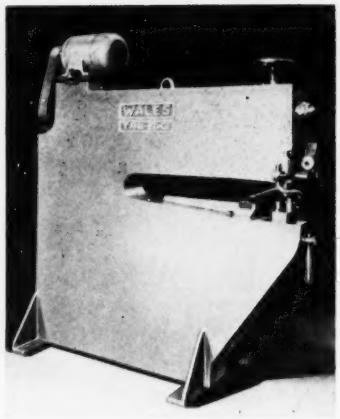
Smooth motion of the table and



Precision boring and drilling machine built by Bryant Chucking Grinder Co.

freedom from vibration enable this machine to produce a fine finish with a single-point tool. The bed, bridge, heads, and table are Meehanite castings. The table moves on preloaded ball slides and is mechanically actuated by a simple cam and lever unit. Cams and change-gears are easily accessible for changing either the length of the stroke or the rate of travel. The motors for driving the cams and the boring heads are mounted in an accessible fan-ventilated recess inside the bed.

Ample fixture mounting surface is provided on the table, which measures 17 1/2 by 22 inches and has three 1/2-inch T-slots. A wide variety of fixtures can be accommodated. The design takes full advantage of standard stock parts, including brakes, motors, air cylinder, bearings, pneumatic follower system, lubrication hoses, and all electrical apparatus. Either low- or high-pressure coolant systems are available. All electrical equipment conforms to J.I.C. standards.



Giant model "Tru-Edge" shear

Wales "Tru-Edge" Shear

A giant model shear with a throat depth of 36 inches has just been announced by the Wales Strippit Corporation, Dept. M, 345 Payne Ave., North Tonawanda, N. Y. This shear is designed for contour and straight inside and outside shearing, beading and producing louvers, and similar work. It has a capacity for handling mild steel up to 9/32 inch in thickness at speeds of from 10 to 36 feet per minute, depending on the gage and material. A new shearing principle is said to eliminate resistance to feeding and turning the work.

The unique design of the actuating cam is said to provide vibrationless operation that produces a smoothly cut edge on the work.

S K F Improved Spherical Roller Bearings

Spherical roller bearings of the improved design shown in Fig. 1, recently announced by S K F Industries, Inc., Dept. 616A, Philadelphia 32, Pa., are said to have from 25 to 50 per cent greater bearing capacity and a service life from two to three and a half times longer than preceding spherical roller bearings of the same nominal size and type—and without any change in size or weight. Thousands of these improved bearings are already in successful use in railroad journals, vibrating screens, steel mill machinery, and similar equipment.

The inner race of the bearing, shown in the cross-sectional view at the right in Fig. 2, is without the under-cuts and integral flanges of the earlier spherical roller bearings seen at the left. This permits the use of longer rollers of greater capacity.

Each row of rollers is held in a window type cage made of high-tensile strength, cold-rolled brass. This cage is very strong mechanically and is well supported. Even when used in applications where stresses upon the cage are most severe, such as eccentric locations in shaker screens, trouble-free operation has been obtained. Each cage is centered or located on two large areas, one directly on the inner ring outside the rollers and the other on the guide ring. This bearing is capable of carrying heavier combinations of radial and thrust loads, or pure thrust loads.

The rolling, self-aligning feature has been preserved, so that considerable misalignment between the shaft and housing has no ill effect on the capacity or life of the bearing. This spherical roller bearing, designated the "C" type, is made in Series 222 and 223.

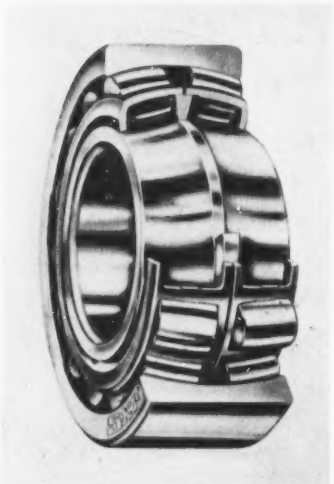


Fig. 1. S K F spherical roller bearing of improved design

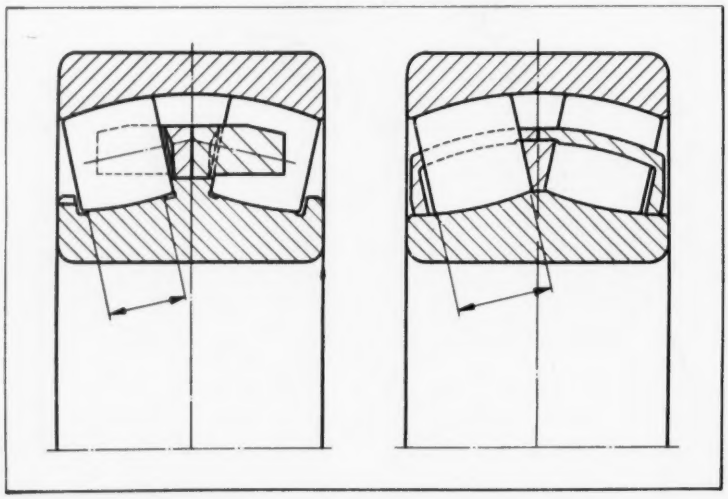
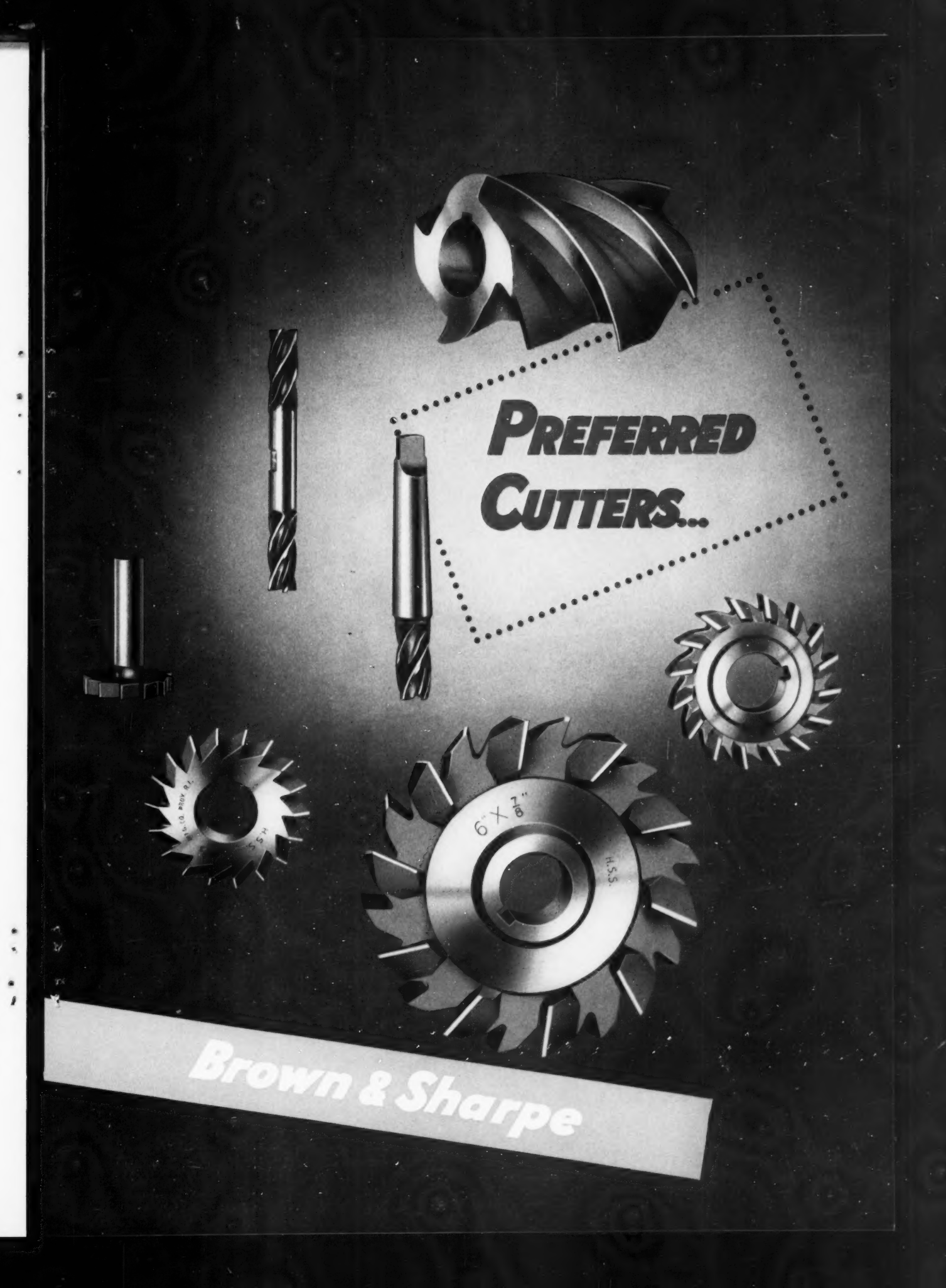


Fig. 2. (Left) Cross-sectional view showing design of original S K F spherical roller bearing, and (right) of improved spherical roller bearing

(*Continued on page* 253)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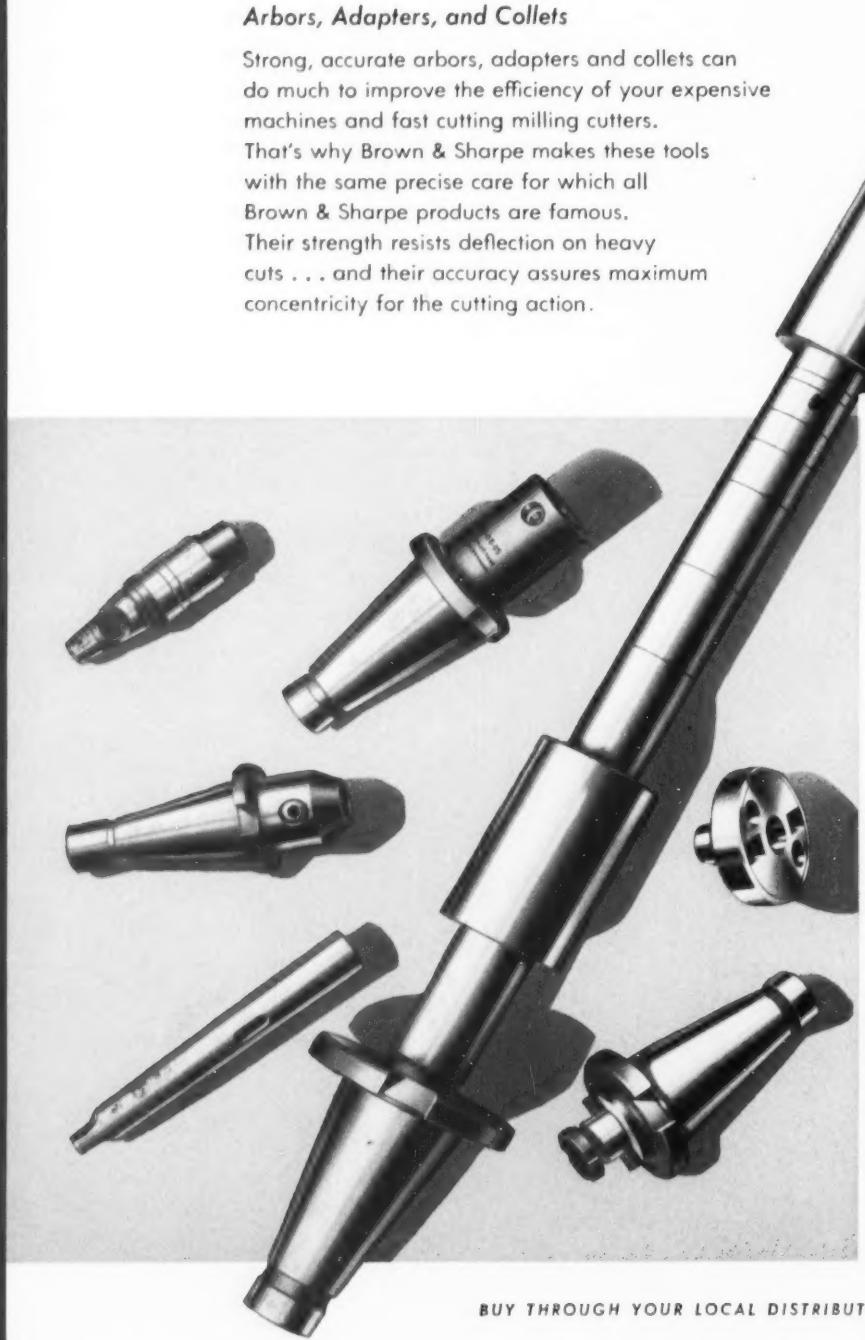

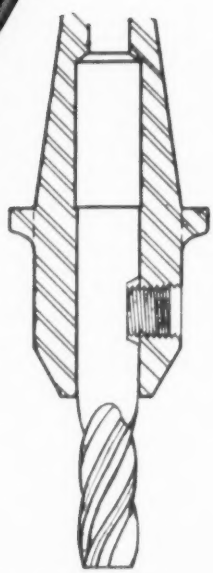

Cutter Adapters for Straight Shank End Mills

Many Brown & Sharpe Adapters incorporate this "quick-set", "quick-release" method for holding single- and double-end end mills. Safety Set Screw holds shank of cutter securely . . . a quick turn of a wrench locks or releases end mill. Long, straight bearing surface assures concentric cutting.

Write for the new Catalog 35C which describes in detail the complete line of Brown & Sharpe Cutters, Hobs, Arbors, Adapters, and Collets.

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Leeds & Northrup "Homocarb" Furnace

A heat-treating forced-convection furnace with automatic control of temperature and atmosphere throughout both the heating and quenching cycles has been brought out by the Leeds & Northrup Co., Dept. M, 4908 Stenton Ave., Philadelphia 44, Pa. From the time a load enters this furnace until it leaves the quench, it is never exposed to air. The equipment consists of a horizontal Homocarb furnace; Microcarb atmosphere control; and L&N temperature control.

The furnace combines in one unit a heating chamber, a quench tank, and a protective-atmosphere vestibule. In the heating chamber a high-pressure fan circulates heat and atmosphere uniformly through the load. In the quench, a motor-driven pump circulates oil down through the load.

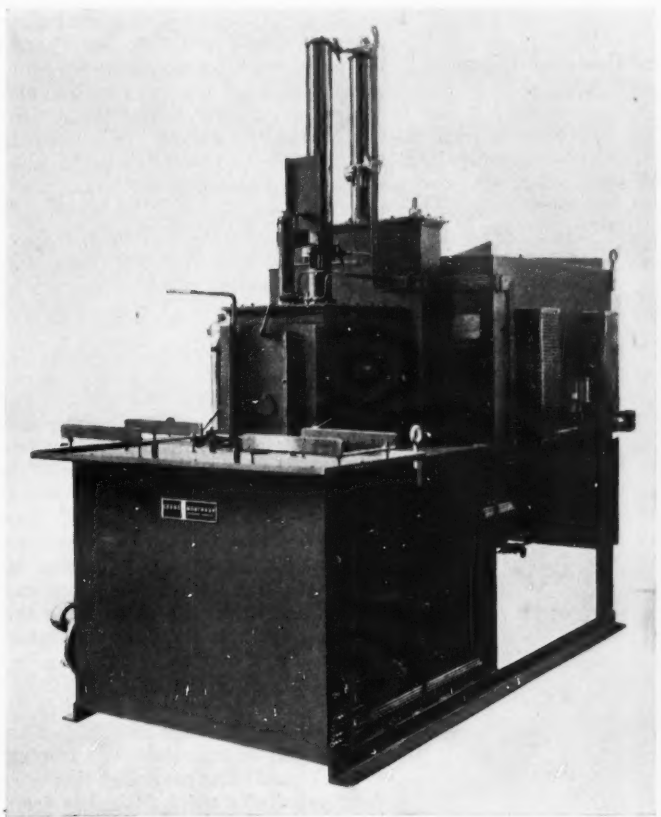
The microcarb atmosphere control is used for directly measuring and controlling the carbon content of the atmosphere surrounding the work during the heat-treating cycle. The detecting element is a "Carbohm" in the work chamber.

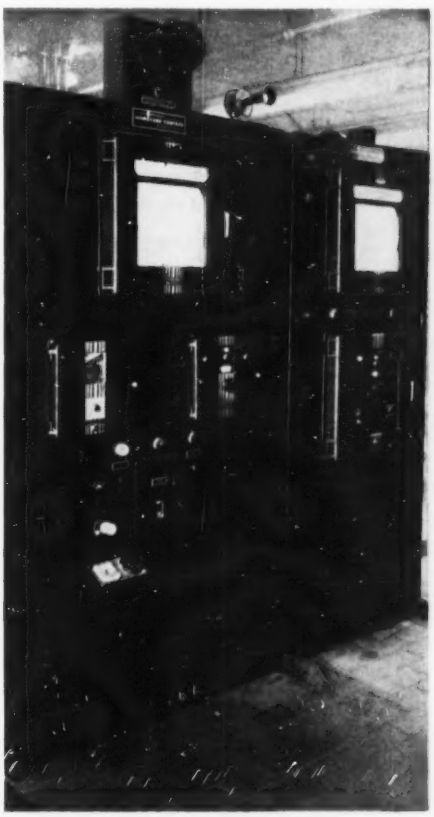
Temperature in the heating chamber is controlled by the D.A.T. three-function control system. In addition, an Electromax on-off controller regulates the temperature of the quench oil by operating a heat exchanger or immersion heater. The equipment can be used for temperatures between 1500 and 1750 degrees F., and throughout a carbon range of 0.15 to 1.15 per cent for hardening, carburizing and carbon restoration.

"Extended width" slotting cutter

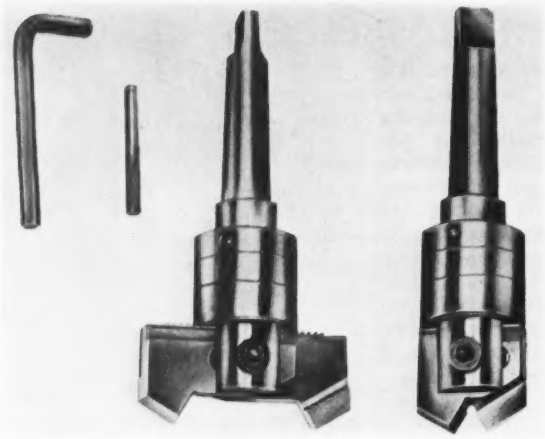
Milling Cutter Line Using only Two Blade Sizes

Millit, Inc., Dept. M, 55 Flint St., Rochester 8, N. Y., has announced the addition of "extended width" slotting cutters to its standard milling cutter line. A staggered tooth method of mounting replaceable blades allows the manufacturer to make any width cutter desired. The use of only two blade sizes in the complete line of cutters simplifies blade stocking problems. Aside from staggered tooth slotting, the extended width cutter can also be used for heavy side milling where increased cutter width is desirable. These cutters are available from 4 to 14 inches in diameter, and for cuts over 1/2 inch wide.

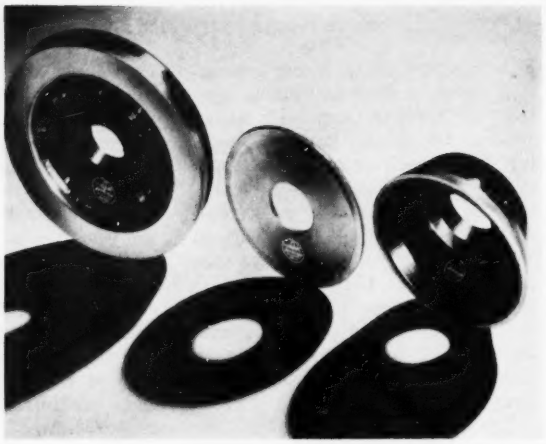




(Left) "Homocarb" heat-treating furnace with protected quench brought out by the Leeds & Northrup Co.
(Right) Instrument panels for temperature and atmosphere control during heating and quenching



Hayden drill with small blades fully contracted (right) and large blades fully extended (left)



Jetaline bonded straight cup, straight peripheral, and flaring cup diamond grinding wheels

Adjustable Drill with Two Sets of Blades

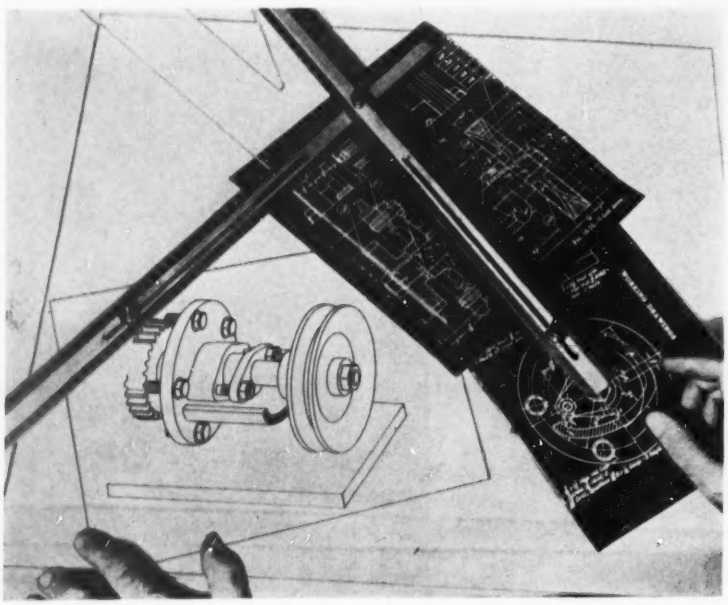
An adjustable drill has been developed by the Hayden Twist Drill Co., Dept. M, 8626 Lyndon Ave., Detroit 38, Mich., that can cut any size hole from 2 to 3 inches in diameter with one set of blades and from 3 to 4 inches in diameter with a second set of blades. A scroll ring engaging the bottom sides of the blades performs the double function of adjusting the blades and supporting them against the thrust of the cut. The body of the drill is made of heat-treated alloy steel, and the blades are made of high-speed steel. Carbide-tipped blades are available at extra cost.

The drill can be used on upright or radial drill presses, horizontal boring mills, vertical jig borers, milling machines, turret lathes, and tool-room or engine lathes. The blades are easily modified to produce round corners, flat bottoms, angular surfaces, or steps.

Metal-Bonded Diamond Wheels

Jetaline diamond wheels that are said to have an exceptionally fast cutting action on carbide have been developed by the Action Diamond Tool Co. Dept. M, 4545 W. Grand Ave., Chicago 39, Ill. Used with a coolant, a straight wheel of this line will cut a slot 1/8 inch wide and about 1/4 inch deep in a carbide blank 1 inch long in a single pass. Other carbide grinding operations are equally as fast.

The unusual cutting action is due to the use of a special alloy metal bond which is non-glazing and non-loading, thus avoiding overheating and the need for diamond wheel redressing. Fine diamond mesh metal-bonded wheels in this line can be used for micron finishing.



Adapto-Arm for producing trimetric drawings made by the Wilkinson Co.

Wilkinson Adapto-Arm for Production of Axonometric Projection Drawings

The Wilkinson Co., Dept. M, Box 638, Arnold, Md., has brought out a drawing instrument designed to produce isometric, dimetric and trimetric drawings by tracing the normal orthographic views of a part or machine. This instrument, called the "Adapto-Arm," has three moving parts. One part, the channel track, is 52 inches in length, and has two ears, top and bottom, that facilitate tacking the channel track to the drawing table. The marking link and the tracing link are the other two parts.

A runner that slides freely in the channel track is attached at one end of each link. The tracing link and the marking link are pivoted at a point 24 inches from the runners. Slots in each link provide means of fastening the marker and tracer. The marker

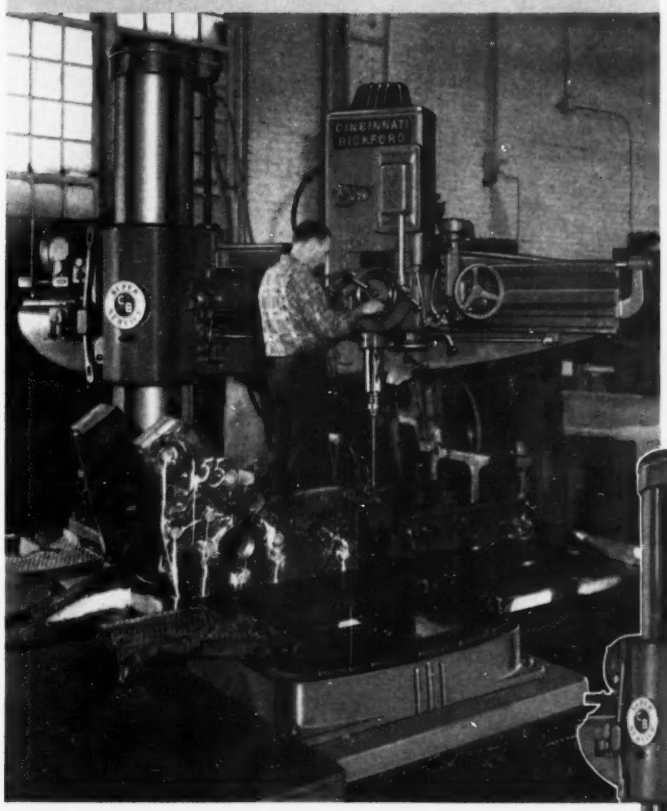
"top performers"

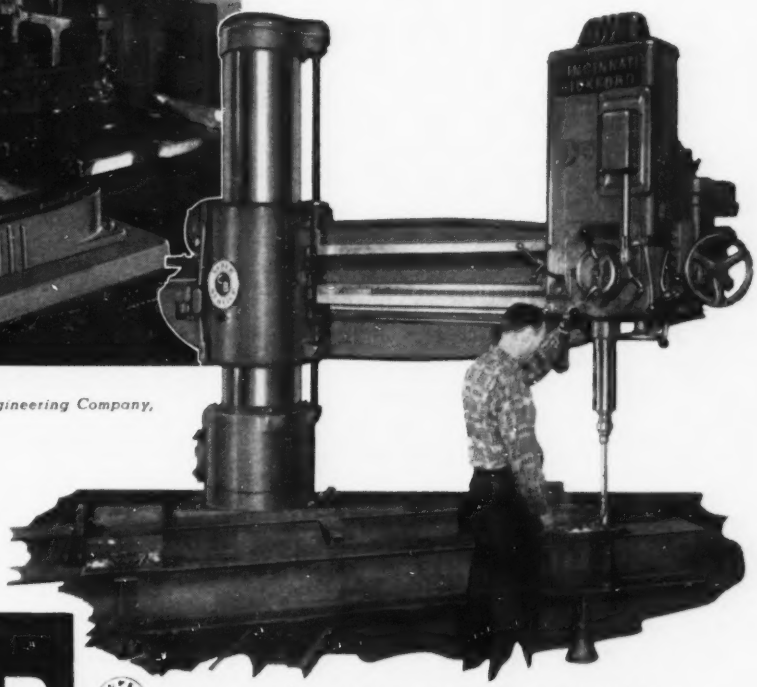
AETNA-STANDARD ENGINEERING CO.
ELLWOOD CITY, PA.

The Aetna - Standard Engineering Company say—"It is our opinion on radial drills that Cincinnati Bickford Super Service Radial Drills are top performers from the standpoint of service and handling ease".

Illustrations show the top carriage of gun carriage being drilled, tapped and reamed complete on this Cincinnati Bickford Super Service Radial—holes from ¼" to 1¼", limits within .0005".

Write for Booklet R-29.





Photos courtesy of the Aetna-Standard Engineering Company, Ellwood City, Pa.

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.
Cincinnati 9, Ohio, U.S.A.

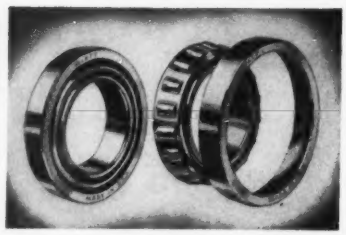
and the tracer have small chucks, designed for holding drawing leads, as in the case of the marker, or a steel point in the case of the tracer. The illustration shows the Adapto-Arm being used to draw the teeth of a gear in the trimetric drawing on the lower left-hand corner of the drawing board by tracing the outline in the normal orthographic view at the right.

Extractor for small bushings

Crozier Bushing Extractor

A bushing and bearing extractor that can be used in small size holes has recently been brought out by the Crozier Machine Tool Co., Dept. M, 684 N. Prairie Ave., Hawthorne, Calif. The unit can handle the extraction of bushings, bearings, and sleeves from holes 1/4 to 25/32 inch in diameter.

Series 100, as the extractor has been designated, is available with one, two, four, or ten expanding arbors to a set. Starter sets include a steel carrying box, drawtable, draw-nut, and anti-friction washer. There is a choice of any two expanding arbors.



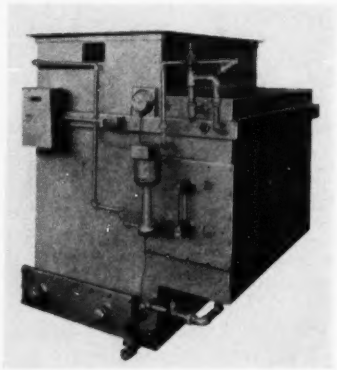
Self-aligning barrel bearing brought out by the Hyatt Bearing Division of General Motors Corporation

Hyatt Self-Aligning Barrel Bearing

A self-aligning barrel bearing is now being manufactured for general industrial applications by the Hyatt Bearings Division of General Motors Corporation, Dept. M, Harrison, N. J. The accurately ground barrel-shaped rollers of this bearing, combined with precise race contours, provide maximum load-carrying capacity throughout a wide range of operating conditions. These angular contact bearings are designed to sustain radial, thrust, or combination loads, and are freely self-aligning. Conditions of shaft misalignment do not interfere with their operation.

Carbide-Tipped Gun Drill

A carbide-tipped gun drill for deep-hole drilling operations has been announced by Chicago-Latrobe, Dept. M, 411 W. Ontario St., Chicago 10, Ill. This drill was developed to permit the production of deep holes in materials generally considered impossible to drill. It is designed to minimize run-out by maintaining close drilling concentricity and to produce a hole that is comparable in size to one obtained by reaming. Increased production is said to be obtained with the new drill because of the high speeds possible with the carbide tip. Longer tool life and the capacity for drilling practically every material used in industry are also advantages claimed for this drill.

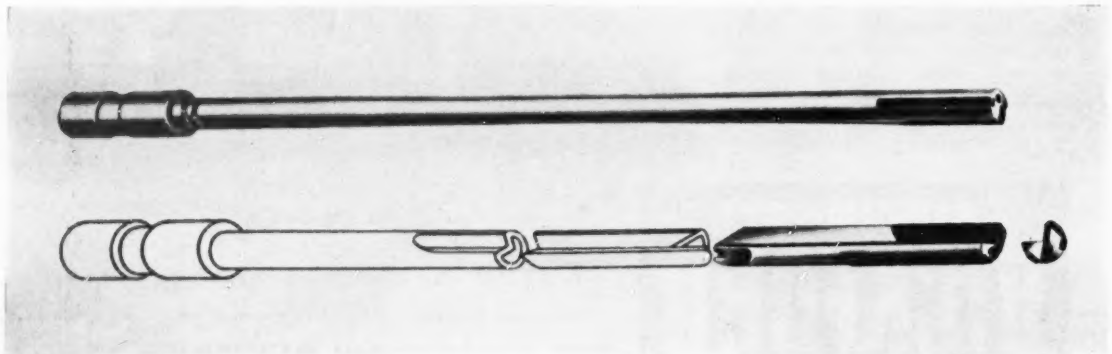


Improved Metalwash vapor degreaser

Metalwash Vapor Degreaser

The Metalwash Machinery Corporation, Dept. M, 901 North Ave., Elizabeth 4, N. J., has brought out an improved Metalwash vapor degreaser. This degreaser incorporates such features as obstruction-free tank walls, recessed condensing coils, removable pump chamber, and water separator manufactured of solid stainless steel.

The condensing coil commonly located around the interior walls of a vapor degreaser has been recessed into a back compartment and the solvent condensate trough normally found under this coil has been replaced by a large sloped condensate tray, also recessed, di-



Carbide-tipped gun drill for deep-hole drilling operations developed by Chicago-Latrobe

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rectly underneath the new type of condensing coil. This recessed multiple-tiered condensing coil extends for the full length of the degreaser and gives the same control of vapors as formerly obtained with the coil completely around the tank interior.

The water separator and pump compartment are welded to a flanged plate to permit removal of the complete unit to allow periodic inspection of the storage tank interior. This permits the conversion of a straight vapor degreaser to a vapor spray degreaser.

Thor reversible air-operated screwdriver and nutsetter

Thor Reversible Air-Operated Screwdrivers and Nutsetters

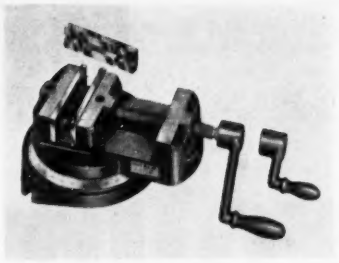
A series of twenty-four lightweight, air-operated, reversible screwdrivers and nutsetters has been added to the No. 2 line of air tools by the Thor Power Tool Co., Dept. M, Aurora, Ill. They are reversible for removing or applying threaded fasteners.

This line is available in four basic speeds ranging from 475 to 2000 R.P.M. Each is offered with either a slip clutch (for exacting tension control) or a positive clutch (for manual control). Also, a lever throttle or pistol type throttle can be furnished. Eight additional models feature a 25 per cent slip clutch drive. Their weight is two pounds.

Kenco Milling Vises

The Kenco Mfg. Co., Dept. M, 5211 Telegraph Road, Los Angeles 22, Calif., has brought out a 6-inch vise designed to provide maximum rigidity and eliminate vibration. The graduations on the swivel base at an angle of 45 degrees from the horizontal permit easy reading from 0 to 90 degrees and back. Markers at the right-hand and left-hand sides give identical readings. The movable jaw is secured by means of a slide plate and can be locked solidly in place after the work is clamped in position.

The vise body can be removed for use without the base. Standard equipment includes three hard-face jaw plates. One set of jaw plates has milled vees for holding round work in both horizontal and vertical positions. The other two jaws are for conventional type work. Each vise comes with two handles, a short handle which will clear the table and a large handle for applying heavier clamping pressure. A 4-inch vise of similar structure is also available. The larger vise weighs 55 pounds, and the smaller 16 pounds.



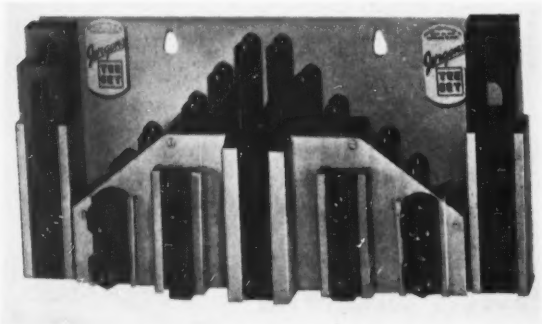
Kenco swivel base vise with two handles

Versatile Machine Tool Set-Up Kit

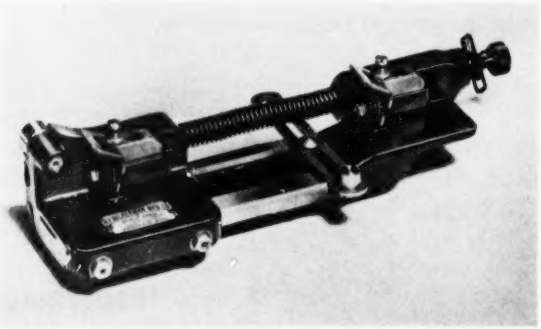
Machine set-up kits in a wide range of stud and nut sizes have been announced by the Jergens Tool Specialty Co., Dept. M, 712 E. 163rd St., Cleveland 10, Ohio. This kit contains twenty-four studs; and four each of extension nut couplers, flange nuts, T-slot nuts and strap clamps. Studs are available in diameters of 3/8, 1/2, 5/8, and 3/4 inch and three different T-slot nut sizes are available for each stud diameter. The kit comes with a steel holder, wooden inserts holding the studs in position. All parts are of heat-treated alloy steel with a black finish.

Hitch Type Feed for Punch Press Die

Feed lengths up to 2 1/2 inches for stock having a maximum thickness, of 0.031 inch may be obtained with the 2 1/2-inch Model K hitch feed developed by the H. E. Dickerman Mfg. Co., Dept. M, 321 Albany St., Springfield, Mass. The device incorporates a heavy, semi-steel main frame and a moving member, but retains the gripper plate principle. Stock insertion or removal is performed instantly without tools. The unit can be mounted on the die set, or attached to the bolster. Two or more units can be used to feed separate ribbons of stock.



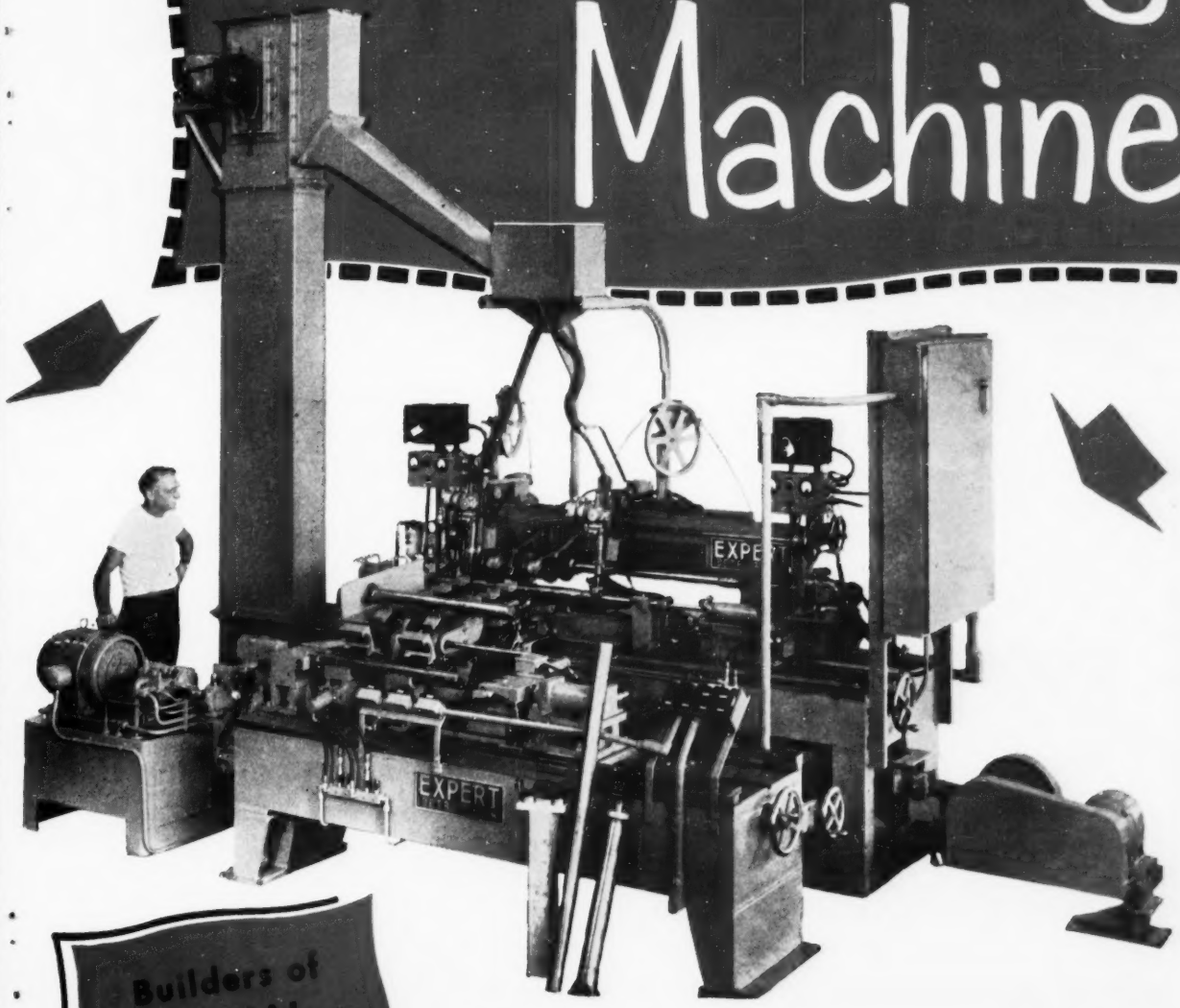
Machine tool set-up kit brought out by the Jergens Tool Specialty Co.



Hitch die feed for punch press developed by H. E. Dickerman Mfg. Co.

AUTOMATIC SUBMERGED

Arc Welding Machine



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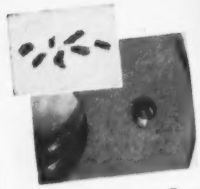
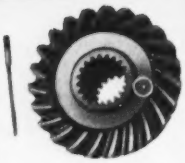
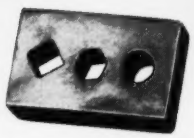


Remove Broken Taps fast without distortion

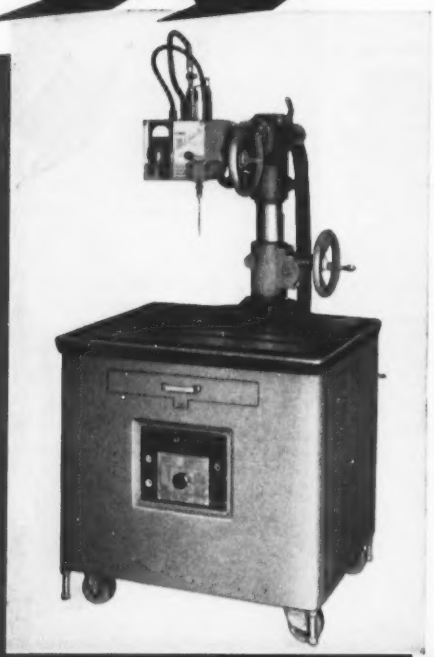


Cut oil holes in hardened gears without annealing

Cut dovetails in hardened dies



Cut any shape hole in cemented carbides



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On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

MACHINE TOOLS AND THEIR LUBRICATION—Shell Oil Co., New York City. 80-page booklet entitled "Machine Tools and Their Lubrication," it is not a shop manual but a discussion of the fundamental factors found in the construction, operation, and maintenance of modern machine tools. There are four sections: History and Development of Machine Tools; Methods Used in Controlling Power and Directing Force in a Machine Tool; Types of Motion and Degrees of Friction in Machine Tools; and Role of the Lubricant in Modern Machine Tool Operation and Maintenance. 1

GAS-SHIELDED WELDING EQUIPMENT—General Electric Co., Schenectady, N. Y. Bulletins GER-819, GEA-6028, and GEC-989 on the recently developed Fillerarc consumable-electrode gas-shielded welding process; on the new equipment for this type of low-cost production welding of aluminum, stainless steel, copper, nickel, magnesium, and other metals; and on operation of the gun, wire drive unit, and welder. 2

ELECTRICAL SWITCHING DEVICES—Carboloy Department of General Electric Co., Detroit, Mich. Technical data sheets TH-9, TH-10, TH-11, and PM-116, giving latest information on methods of using Thermistors, heat-sensitive electrical resistors. The data sheets are titled Time Delay, Temperature Compensation, Contactless Switches, and Magnetic Demonstration. 3

PRODUCTION MILLING MACHINES—Kearney & Trecker Corporation, Milwaukee, Wis. Catalogue consisting of 64 pages of comprehensive information on Kearney & Trecker knee type, plain, universal, and vertical milling machines, as well as details on the timesaving rotary head milling method. Helpful machine selection charts and a description of the company's customer engineering services are also presented. 4

MAGNETIC SEPARATOR AND FILTER—Barnes Drill Co., Rockford, Ill. Bulletin 350, describing the Kleenall combination magnetic separator and filter, a unit that removes metallic sludge and abrasives from liquids and cutting fluids automatically as they flow from the operating position and delivers them clean to the storage area for recirculation. 5

CAST ELEVATOR BUCKETS—Link-Belt Co., Chicago, Ill. Book 2465, on the company's complete line of cast elevator buckets for handling such diverse materials as coal, ores, cement, and chemicals. Instructions for the mounting of buckets on belts and chains are given, with diagrams on bucket punching. 6

TESTING INSTRUMENTS—General Electric Co., Schenectady, N. Y. Bulletin GEA-5469B, consisting of a buyer's guide on electric testing instruments. Application data, features, and prices for such instruments as hook-on voltammeters, wattmeters, and power-factor meters; portable recorders; hand pyrometers; and surface roughness scales are included. 7

GRINDING CEMENTED CARBIDES—The Carborundum Company, Niagara Falls, N. Y. 39-page booklet on grinding cemented carbide with green grit and diamond wheels. New techniques are described, together with abrasive products developed to obtain economical carbide tool manufacture and maintenance. Wheel recommendations are also included. 8

HIGH-FREQUENCY MOTORS—Bryant Chucking Grinder Co., Springfield, Vt. Folder covering Bryant high-frequency rotating equipment. The motors are of small physical size and simple design and are being used for experimental and production applications. They are adapted to meet the requirements of each job. 9

TRAINING METHODS—National Machine Tool Builders' Association, Cleveland, Ohio. Booklet entitled "Key to Survival and Growth," summarizing training methods for use in the metalworking industry. A comprehensive bibliography and summary of motion pictures which cover training subjects are included in the appendix. 10

STAINLESS STEEL FASTENERS—Allmetal Screw Products Co., Inc., Garden City, N. Y. Catalogue 53, containing 96 pages of information on the company's line of fasteners of stainless steel, fittings, and valves. Engineering data and tables are included. The catalogue is available to engineering and manufacturing executives. 11

THERMOCOUPLES—Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. Bulletin TC10, a data book and catalogue showing the Wheelco line of thermocouples, radiation detectors, and resistance bulbs. Included is information concerning various sensing units as well as tips on instrument servicing. 12

GEAR SPEED REDUCERS—D. O. James Gear Mfg. Co., Chicago, Ill. Catalogue 42-B, containing 84 pages of information on the company's line of right-angle gear speed reducers. Recommended practice for the selection of parallel and vertical drives is considered; rating tables are provided. 13

ACCESSORIES FOR LATHES, DRILL PRESSES, AND SHAPERS—South Bend Lathe Works, South Bend, Ind. Catalogue 5321C entitled "165 Reasons Why," containing information and prices on the many machine tool attachments and accessories, all of which are illustrated, for South Bend lathes, drill presses, and shapers. 14

GEARS—Grant Gear Works, Inc., Boston, Mass. Catalogue 70, containing 176 pages of information on the company's entire line of stock gears, speed reducers, sprockets and chains, couplings, and special gears. Useful tables and engineering information relating to power transmissions are also presented. 15

TRAINING MACHINISTS—Bureau of Apprenticeship, U. S. Department of Labor, Washington, D. C. Technical Bulletin T-138 entitled "A Half-Century of Experience in Training Machinists," comprising an analysis of the operation of the apprenticeship system by the Kearney & Trecker Corporation. 16

STANDARDS AS A MANAGEMENT TECHNIQUE—American Standards Association, New York City. Booklet entitled "Standards Are Your Business," emphasizing the economic importance of standardization. The booklet defines standards of production and their value as tools of management. 17

CYLINDRICAL GRINDING—Landis Tool Co., Waynesboro, Pa. Booklet CGI-53, featuring fifteen case studies of successful cylindrical grinding installations. Over sixty photographs with operation sketches and specifications show how difficult grinding problems can be solved. 18

CENTRALIZED LUBRICATION—Farval Corporation, Cleveland, Ohio. Booklet comprising six studies in centralized lubrication—for example, a lubrication study of a Clearing press in which it is claimed that the Farval System saves fifty minutes out of every hour of oiling labor. 19

SURFACE FINISHING—Micrometrical Mfg. Co., Ann Arbor, Mich. Leaflet entitled "How to Win Arguments on Surface Roughness," explaining how the Profilometer, an instrument measuring roughness directly in micro-inches, can be used in the shop. 20

MEEHANITE GEAR APPLICATIONS—Meehanite Metal Corporation, New Rochelle, N. Y. Bulletin 42, describing and illustrating many appli-

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cations in which Meehanite gears are being used. The subject of gear casting design is considered. 21

COMPACTING PRESS—Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Bulletin 3101, describing the Baldwin-Defiance Model C, 100-ton, powdered metal compacting press suitable for compacting ceramic parts and grinding wheels, and preforming plastics. 22

SET-UP AND HOLD-DOWN TOOLS—Armstrong Bros. Tool Co., Chicago, Ill. Bulletin SUT, descriptive of T-slot bolts, nuts, and washers for setting up work on planers, shapers, and milling machines; and T-slot and machine strap clamps for holding down work. 23

PRESSES—E. W. Bliss Co., Canton, Ohio. Booklet entitled "The Dominant Factor in Pressed Metal Production," consisting of a pictorial tour of some of the country's major pressed-metal producing industries in which Bliss presses are installed. 24

DRILL STOP AND EXTRACTOR—Wohlnip Engineering Co., Hillside, N. J. Folders descriptive of a drill stop and a drill extractor, the first for positive control of hole depth, and the second for the extraction of broken drills. 25

GRINDING AND POLISHING EQUIPMENT—Murray-Way Corporation, Birmingham, Mich. Bulletin giving varied uses of Micro-Polish units for grinding and polishing coils, blanks, and sheets of steel, brass, aluminum, and other materials. 26

FASTENERS—Triplex Screw Co., Division of the Murray Corporation of America, Cleveland, Ohio. Catalogue 530, containing 80 pages of descriptive information on Triplex threaded fasteners—nuts, bolts, screws, washers, and rivets. 27

ELECTRIC HOIST—Shepard Niles Crane & Hoist Corporation, Montour Falls, N. Y. Bulletin 182, describing the Liftabout Jr., a lightweight electric hoist designed for intermittent duty. It is available in from 250- to 2000-pound capacities. 28

HORIZONTAL EXTRUSION PRESSES—Lake Erie Engineering Corporation, Buffalo, N. Y. Bulletin 14.9, describing the Lake Erie horizontal extrusion presses designed for extruding rods, tubes, and shapes in aluminum, brass, magnesium, and other non-ferrous metals. 29

PNEUMATIC BAR FEED—Lipe-Rollway Corporation, Syracuse, N. Y. Folder describing the Lipe-Rollway automatic magazine loading pneumatic bar feed for use with most types of single-spindle automatic screw machines and other tools. 30

CUTTING AND GRINDING FLUID SELECTOR—D. A. Stuart Oil Co., Ltd., Chicago, Ill. Cutting and grinding fluid selector to help determine which cutting fluid can be used for common machining operations on various metals. 31

ZINC DIE CASTINGS—New Jersey Zinc Co., New York City. Booklet entitled "The End Uses of Zinc Die Castings," illustrating finished products in which zinc die castings are used, including industrial equipment, tools, and business machines. 32

PERMANENT MAGNETS—Carboloy Department of General Electric Co., Detroit, Mich. Technical Report PM-112, giving latest information on the uses, design, properties, and manufacture of Alnico permanent magnets, cast grade 7. Graphs and tables explain magnetic and physical characteristics. 33

SHAPERS, SHEARS, AND PRESS BRAKES—Cincinnati Shaper Co., Cincinnati, Ohio. Booklet entitled "The Magic Circle," showing the company's machines, as well as the new shop building in which they are being built. 34

CONTOUR MILLING CUTTER—Douglas Tool Co., Hazel Park, Mich. Bulletin 6, descriptive of the Douglas Hi-Helix contour milling cutter. Bulletin 7, on machining titanium with Hi-Helix cutters used as face mills. 35

AIR TOOLS—Thor Power Tool Co., Aurora, Ill. Catalogue JE-1660, presenting descriptions and specifications of the Thor No. 2 series of lightweight, air-operated drills, grinders, screwdrivers, and nutsetters. 36

WET-BLASTING—Cro-Plate Co., Inc., Hartford, Conn. Booklet depicting case histories of Pressure-Blast wet-blasting applications and showing Pressure-Blast models and specially designed units. 37

CLUTCH COUPLINGS—Hilliard Corporation, Elmira, N. Y. Leaflet descriptive of Hilliard Twiflex automatic centrifugal clutch couplings with flexible action, giving general dimensions and load capacity. 38

METAL WASHING COMPOUND—Ipsen Industries, Inc., Rockford, Ill. Leaflet descriptive of Compound 103, a new Ipsen heavy-duty metal washing compound suitable for both batch and spray type washers. 39

POWER-DRIVEN COIL CRADLE—Wm. Halpern & Co., Inc., Mount Vernon, N. Y. Leaflet describing the Medelton grip feed motor-driven Poweroll for uncoiling and feeding stock into a press. 40

INCLINABLE PRESSES—V & O Press Co., Hudson, N. Y. Booklet explaining the long slide principle for power presses, and describing and illustrating construction features of V & O inclinable presses. 41

BROACH BARS AND FIXTURES—Cleveland Broach, Inc., Cleveland, Ohio. Folder covering the company's line of broach bars and fixtures for the jet-engine, automotive, and allied industries. 42

HONING—Sunnen Products Co., St. Louis, Mo. Booklet X-1 BA-5001, giving typical examples of parts honed on Sunnen machines. Internal and external applications are included. 43

COOLANT PUMP—Ruthman Machinery Co., Cincinnati, Ohio. Bulletin 53-A, on the Ruthman Baby Gushar, a coolant pump for small machine tools available in six application types. 44

FREQUENCY CONVERTER—Gegrator Corporation, Manassas, Va. Circular E-11, describing the "Nobrush" frequency converter, a compact motor-generator unit to convert 60 to 400 cycles. 45

HYDRAULIC CYLINDERS—Mullins Mfg. Corporation, Koldflo Division, Salem, Ohio. Bulletin 2, descriptive of Mullins steel Koldflo cylinders for application in the fluid power industry. 46

METAL STAMPINGS—Kickhaefer Mfg. Co., Milwaukee, Wis. 64-page booklet giving engineering specifications for metal stampings that can be supplied without die charges. 47

SPINDLE FOR JIG BORER—Fosdick Machine Tool Co., Cincinnati, Ohio. Bulletin describing the new BF spindle for use on Fosdick jig borers and automatic positioning machines. 48

DRILL UNIT—Hause Engineering, Montpelier, Ohio. Circular 1753, on the lightweight Hause Holomatic Model 14 drill unit for drilling, tapping, threading, and reaming. 49

AUTOMATIC TURRET LATHE—Potter & Johnston Co., Pawtucket ,R. I. Bulletin 130, giving an informative description of the Potter & Johnston 4D automatic chucking and turning machine. 50

HACK- AND BAND-SAW BLADES—Clemson Bros., Inc., Middletown, N. Y. Booklet giving hints on the proper selection and use of hand and power hack-saw blades and flexible back band saws. 51

DECIMAL EQUIVALENTS, AND TAP DRILL AND SCREW THREAD CHART—Reiff & Nestor Co., Lykens, Pa. Vinylite pocket-size chart listing decimal equivalents from 1/64 to 1 inch, and screw thread and tap drill sizes. .. 52

WELDMENTS—Graver Tank & Mfg. Co., Inc., East Chicago, Ind. Booklet giving examples of Graver weldments. The company's engineering and plant facilities are described. 53

HEAVY-DUTY METAL-CUTTING SAW—Peerless Machine Co., Racine, Wis. Bulletin HC50, on the improved Peerless Hydra-Cut hydraulic saw for production cutting. 54

ASTM RESEARCH REVIEW—American Society for Testing Materials, Philadelphia, Pa. Pamphlet summarizing in digest form the work of the various technical committees of the Society. 55

PLANT LAY-OUT SYSTEM—Peerless Photo Products, Inc., Shoreham, N. Y. Bulletin descriptive of a plant lay-out system developed by the company involving the use of photocopy. 56

DIAMOND WHEEL OIL—Carbide Finishing Products, Milford, Conn. Leaflet descriptive of Precision diamond wheel oil for grinding carbides, and of diamond wheel oil applicators. 57

AIR AND HYDRAULIC CONTROL VALVES—C. B. Hunt & Son, Inc., Salem, Mich. Catalogue 531, describing the Quick-As-Wink line of air and hydraulic control valves. 58

BERYLLIUM COPPER—Beryllium Corporation, Reading, Pa. Booklet entitled "Applications Unlimited," illustrating uses of beryllium copper in diverse products. 59

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

Circle numbers of the catalogue items in which you are interested.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	

For more details on products mentioned in the editorial pages or shown in the advertisements in this issue, fill in below:

PAGE .....PRODUCT .....

PAGE .....PRODUCT .....

Please print your name and address

YOUR NAME .....TITLE .....

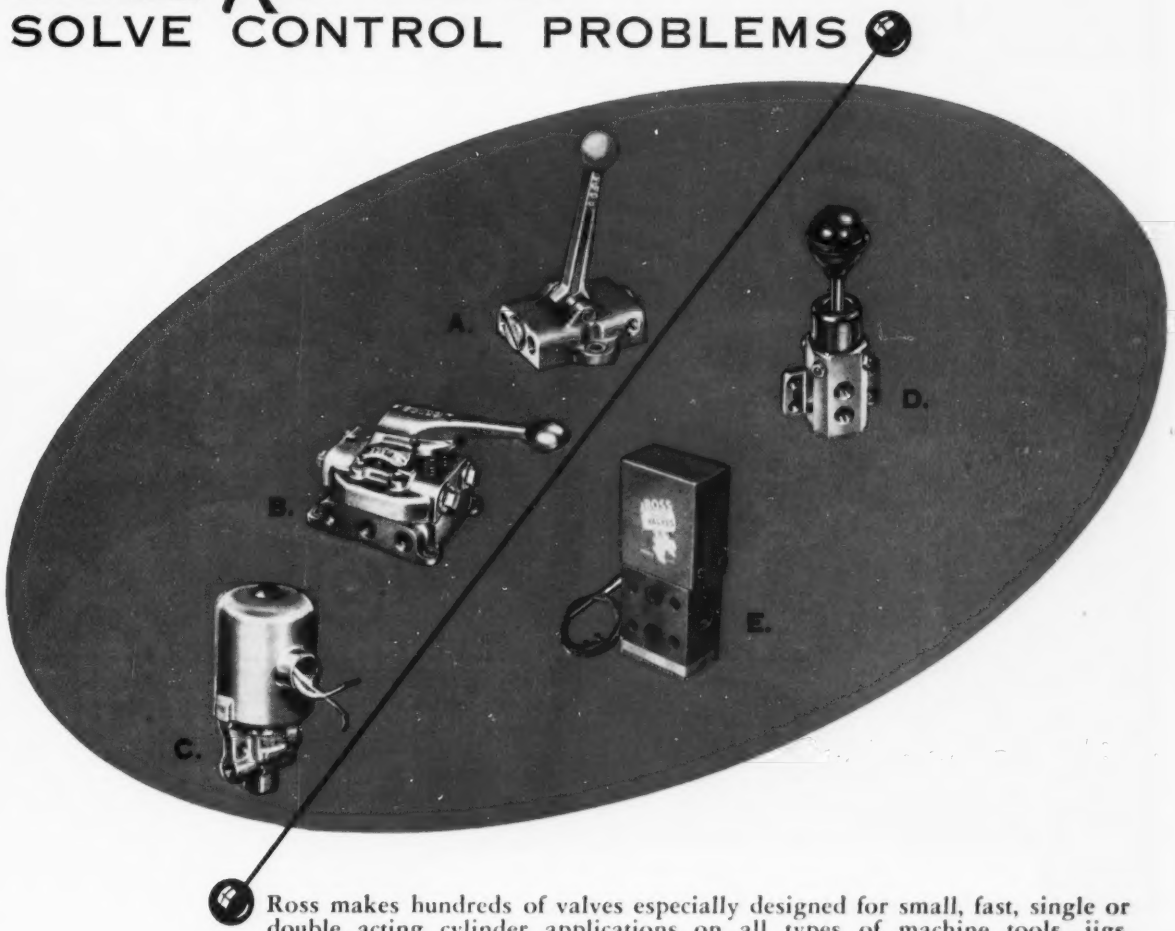
COMPANY .....

CO. ADDRESS .....

CITY .....ZONE.....STATE.....

This card is void after February 1, 1954 M-11/53

SMALL *Ross* VALVES SOLVE CONTROL PROBLEMS



Ross makes hundreds of valves especially designed for small, fast, single or double acting cylinder applications on all types of machine tools, jigs, fixtures, small punch presses and for remote pilot operation of large valves.

A. 600 series—three-way or four-way—hand and foot—¼" pipe—horizontal or vertical handle—single or double treadle.

B. 880 series—three-way or four-way—hand and foot—¼" and ⅜" pipe—horizontal or vertical handle—single or double treadle.

C. Inline direct operated solenoid — straight-way and three-way — normally open and normally closed —⅛" pipe.

D. Straight-way or three-way normally closed — ¼" pipe — various heads.

E. Four-way direct operated solenoid—¼" pipe—can be converted to three-way by plugging cylinder port.

Large or small—Ross has the most complete line of operating valves in the industry. Ask Ross for any air control information.

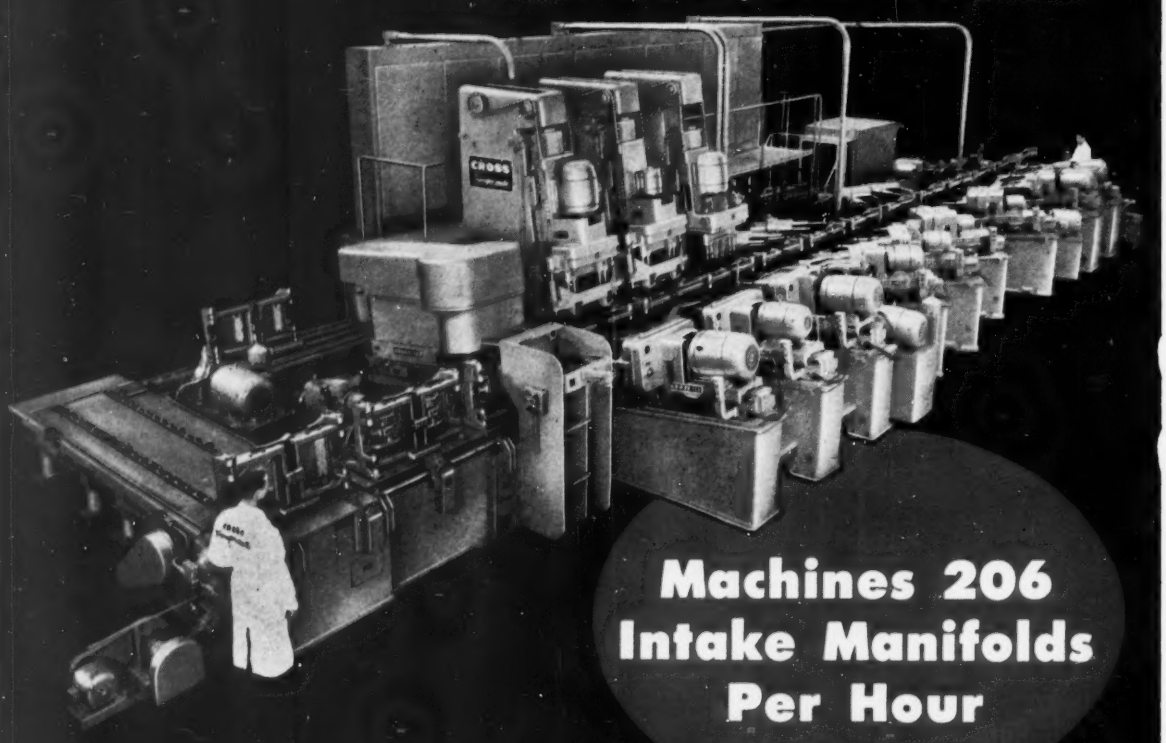
ROSS Control VALVES

Ross CONTROL

OPERATING VALVE COMPANY

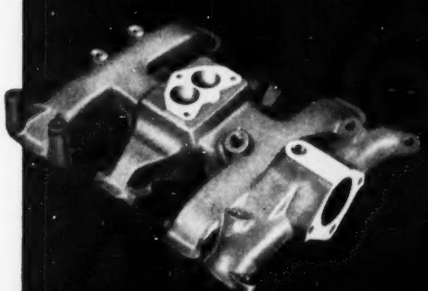
110 E. GOLDEN GATE AVENUE • DETROIT 3 • MICHIGAN

Another Transfer-matic by Cross



Machines 206 Intake Manifolds Per Hour

- ★ Two parts machined at one time in each station.
- ★ 100 operations—two milling, 48 drilling, four boring, 20 chamfering, four spotfacing, and 22 tapping.
- ★ 14 stations—one loading, one unloading, 12 working.
- ★ Palletized work holding fixtures with power wrenches for automatic clamping.
- ★ Integral conveyor for automatic return of palletized fixtures from unloading to loading station.
- ★ Other features — automatic chip removal; hardened and ground ways; automatic lubrication system; J. I. C. standard construction.



Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 261

Between Grinds

By E. S. Salichs

Ach! Unser Mishtake

To bring MACHINERY'S circulation statistics up to date, a form letter was being sent to subscribers verifying the firm product or line of business. In writing to a German concern, the clerk doing this job studied somewhat futilely the address given on a letterhead of the company in question and then sent the form inquiry to Spradow-Bünde Street in the town of Rohrbogen. The reply came back from the town of Spradow-Bünde. Rohrbogen is what the firm does—pipe bending.

The Catch in the Office

Thinking of Texans as great outdoors men, it was somewhat of a shock to see in *Ford Farming* a picture of a Texan sitting in his air-conditioned office fishing. The Texan, a Buffel grass cultivator, built his comfortable office on stilts over an irrigation pond. He usually invites a friend in, they sink into easy chairs, flip up a trap door, and drop their lines through the floor.

Primitive Plating

An electroplater at Convair, who has been plying his trade for some fifty-eight years, was recently interviewed by *Convairiety*. Robert Johnston's father was a Scottish plater, so in the 90's Son Rob also took up the trade in a small Clydebank shop where individual parts were cooled by swinging them through the air, a practice that was apt to spray everyone in the room. Wooden shoes to keep acid off the feet and white cloth aprons, the symbol of the trade, were worn. Before leaving at night, tanks were cooled by tossing cold water into them, which filled the room with steam and automatically stopped work. Rob then earned $2 for a sixty-hour week.

A Polished Answer

In cleaning white shoes this summer, the household duly noted on the label of the liquid polish bottle the proud words "Contains Titanium." Why? The man of the household, being both a mental and metal giant, immediately replied: "In this instance, titanium prevents oxidation; in other words, it keeps the cleaner from yellowing."

That, Too

In February, MACHINERY ran an article under the title "Be Kind to Your Hobs." Requests still come in for copies of it; the last received must have been written by a typist just back from her vacation down on the farm because the letter specified "Be Kind to Your Hogs."

THE HEART OF THE COLOR TELEVISION TUBE—This complex mount held aloft contains three guns. Each gun triggers one of the phosphor basic color dots (red, blue, and green); the simultaneous firing of the three guns produces the proper color combinations on multi-dotted color TV screens. Jack Kleinoder, general manager of John Volkert Metal Stampings, Inc., which is designing and building dies for the production of these gun parts, is holding the open sesame to rampant, riotous color on your TV screen. Blondes will be blonder dot, redheads redder dot dot, and brunettes sultrier dot dot dot . . .

News

California and Texas

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, has expanded its engineering and technical service facilities on the West Coast by the establishment of a direct factory sales office in San Francisco, Calif. The new office will serve northern and central California and northwest Nevada. WALTER A. JENSEN, who was in the Buffalo, N. Y., office of the company, has been transferred to San Francisco where he will report to the West Coast district sales manager, ANDREW C. PERRIN; while PERRY DUDLEY, JR., who was in Cleveland, has been assigned to the Los Angeles, Calif., office. PETER W. WEST will replace Mr. Jensen in Buffalo.

BRUCE C. ELLIOTT has been appointed head of the newly formed market research department by the Axelson Mfg. Co. Division, Pressed Steel Car Co., Inc., Los Angeles, Calif. Mr. Elliott has been with the Axelson Aircraft Sales Division since 1949.

FARRAND OPTICAL CO., INC., New York City, announces the opening of a West Coast Engineering office at 5896 W. Adams Blvd., Culver City, Calif., with R. A. HAMILTON as consulting engineer, optical tooling, and E. L. FISCHER as technical representative.

JAMES H. KNAPP CO., manufacturer of industrial furnaces, recently moved into its new plant at 1731 Workman St., Los Angeles 31, Calif.

CLECO PNEUMATIC TOOL DIVISION OF REED ROLLER BIT CO., Houston, Tex., recently announced the appointment of the following New Jersey distributors for Cleco products: J. SCHLANK CO., INC., Harrison, N. J.; and ALLIED EQUIPMENT & SUPPLY CO., Bayonne, N. J. The Division also announced the appointment of a distributor in Africa: MATERMACO-CONGO, Elizabethville, Belgian Congo.

Illinois

L. H. GEDDES, vice-president of Greenlee Bros. & Co., was recently elected executive vice-president of Greenlee Bros. & Co. and of its subsidiary, Greenlee Tool Co., Rockford, Ill. At the same time, D. E. HAWKINSON was named vice-president of the parent company in charge of machine tool sales, while R. J. SAMUELSON was elected vice-president of the subsidiary in charge of tool sales. Also announced were the appointments of two assistant sales managers—R. O. KNUDSON, special metal-working machinery; and C. P. BLOCK, automatic screw machines.

(Left to Right) Newly elected officers of Greenlee Bros. & Co.—D. E. Hawkinson, vice-president; R. J. Samuelson, vice-president; and L. H. Geddes, executive vice-president

THOMAS K. WELLS has been appointed to the newly created post of general sales manager of Flexonics Corporation, Maywood, Ill. Mr. Wells has been with the company for twelve years, most recently as sales manager for the Bellows and Aircraft Divisions. HOWARD W. GRIESBACH was appointed assistant sales manager, Bellows Division, while RICHARD H. SABEL was appointed to another new position, sales development manager.

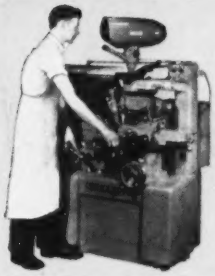
SCULLY-JONES & CO., Chicago, Ill., manufacturer of precision holding tools, recently named the following new distributors: E. A. KINSEY CO., INC., 331-335 W. 4th St., Cincinnati, Ohio, with F. P. BAGGS in charge of sales; PRODUCTION TOOL & SUPPLY CO., 2830-32 Easton Ave., St. Louis, Mo., the president of which is B. JAMES CAHILL; and RICKERT INDUSTRIAL SUPPLY CO., 612 W. Michigan St., Milwaukee, Wis.

BARRETT-CRAVENS CO., Chicago, Ill., manufacturer of materials-handling equipment, is constructing a plant at Northbrook, Ill., which will occupy 150,000 square feet of floor space, and combine the manufacturing operations of the company's two Chicago plants and part of the operations of the Crescent Truck Co., a subsidiary located at Lebanon, Pa. The new plant will also house the Barrett-Electronics Corporation.

ROBERT CARR has been named sales engineer in the Chicago, Ill., sales office of the Reed-Prentice Corporation, Worcester, Mass., manufacturer of lathes, millers, and die-casting, and plastic injection molding machines. Mr. Carr has been with the corporation since 1942, this past

guard *PRECISION* in the shop

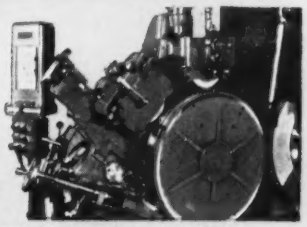
Micro-form Grinder, Model 121 grinds high precision profiles both flat and circular directly from large scale drawing, saving up to 75% over conventional practice.



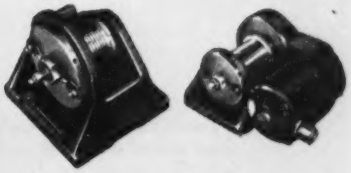
Micro-form Grinder, Model 122 equipped with a combination 30 power microscope and viewing screen.

Thread and Form Grinder, Model 133 uses the multi-ribbed wheel principle to grind small precision threads and intricate forms on a high production basis.

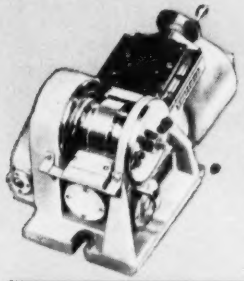
Precision Thread and Form Grinders —100 Series, produce precision threaded elements and cylindrical forms by the Crushtrue method, the diamond dressed multi-ribbed wheel or the single point wheel method.



Special machine tools are a Sheffield specialty, such as this one of 12 jet turbine shroud grinders placed in operation within the last six months.

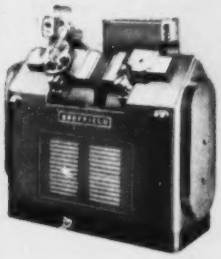


Idler and motorized type Crushtrue devices are available for forming grinding wheels on standard surface grinders.

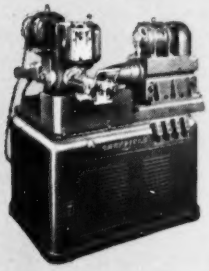


Self-truing Motorized Crushtrue Device forms surface grinder wheels for the grinding of flat form tools, etc. of the highest precision and uniformity.

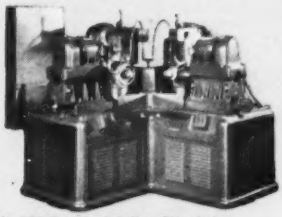
The Sheffield Crushtrue Roll Bank plan provides Rolls for production use while worn rolls are enroute to Sheffield for re-grinding and re-ground rolls are enroute from Sheffield for use. Nominal exchange charge.



Gear and Spline De-burizers deburr or chamfer up to 600 gear teeth per minute. Applicable to spur, helical, hypoid, bevel and herringbone gears —also multi-start worms.



Gear and Spline Chamfering Machines chamfer, burr or recess the ends of gear teeth at high production rates—ideal for short runs and quick changeover.



Style "C" Gear and Spline Chamfering machines have two cutter spindles and two workheads for mass production gear manufacture.

Sheffield is prepared to produce precision threaded elements and formed parts on contract to augment your own manufacturing facilities.

CHECK THE BOX ☑ **for any piece of equipment or service in which you are interested. Tear this out, attach it to your letterhead, mail to Sheffield, and detailed engineering data will be forwarded.**

Machine Tool Division • *The Sheffield Corporation*
Dayton 1, Ohio, U. S. A.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

6559

year having been assistant production manager.

ROCKFORD MACHINE TOOL CO., Rockford, Ill., recently took the first step in a long-term expansion program by breaking ground for a new construction which will add a total of 18,500 square feet to the present plant.

JAMES BERE was recently appointed sales engineer by the Clearing Machine Corporation, Chicago, Ill. Mr. Bere will represent the power press manufacturer in southern Ohio, Kentucky, and West Virginia.

SAFETY SOCKET SCREW CO., Chicago, Ill., announces the completion of its second plant addition, which increases the facilities for manufacturing socket screws by more than 25 per cent.

SPIRAL STEP TOOL CO., Chicago, Ill., recently acquired the CORLETT-TURNER CO., also of Chicago, manufacturer of carbide form tool grinding equipment.

LINDBERG ENGINEERING CO., Chicago, Ill., has moved its Air and Hydraulic Division from the main plant to 225 N. Laflin St.

DONALD CHANDLER recently joined the sales force of the Lufkin Rule Co., Saginaw, Mich. He will be located in the Chicago, Ill., area.

Michigan

NATIONAL BROACH & MACHINE CO., Detroit, Mich., has announced the election of the following new officers: MAX B. MENTLEY, who was plant manager, has become vice-president, manufacturing; BEN F. BREGI, who was executive engineer, has been elected vice-president, engineering; GEORGE R. SMITH, who was assistant secretary and assistant treasurer, has been named treasurer and a director; and D. PIERSON SMITH, sales administrator, has become assistant secretary and assistant treasurer.

ROY C. NICHOLS has joined the Carboloy Department of General Electric Co., Detroit, Mich., in the capacity of engineer in the metallurgical and process quality control unit for permanent magnet materials at the Edmore, Mich., plant. Mr. Nichols was formerly with the Diesel Equipment Division of General Motors at Grand Rapids, Mich.

CLEARING MACHINE CORPORATION, Chicago, Ill., manufacturer of mechanical and hydraulic power presses, recently established an office at 201 1/2 E. Grand River, East Lansing, Mich. The Lansing office will be operated as a branch of the company's Detroit, Mich., office. GEORGE HERRICK will be in charge of the new sales office.

FEDERAL PRODUCTS CORPORATION, Providence, R. I., manufacturer of precision instruments for dimensional control, has just completed a new building to house the Detroit branch at 14340 Puritan Ave., Detroit 27, Mich. ANDREW M. GRANT is Detroit branch manager.

RODNEY E. SAGENDORF has joined the Detrex Corporation, Detroit, Mich., manufacturer of industrial metal-cleaning equipment and chemicals, in the capacity of administrative assistant to the director of sales.

JAMES D. WEBER has been made a sales application engineer in the Detroit, Mich., office of the Reliance Electric & Engineering Co., Cleveland, Ohio.

(Left) Max B. Mentley, who was recently elected vice-president, manufacturing, of the National Broach & Machine Co; and (right) Ben F. Bregi, the new vice-president, engineering

Minnesota, Oklahoma, and Wisconsin

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, recently opened a new sales office in Duluth, Minn., with J. A. RITT as field sales representative. The address of the new office is the Christie Bldg., 120 North Fourth Ave., W., Duluth.

DONALD R. GUTHRIE was recently named assistant general manufacturing manager of the Coated Abrasives and Related Products Division of the Minnesota Mining & Mfg. Co., St. Paul, Minn. Mr. Guthrie was formerly executive engineer in charge of engineering research.

A. A. FOMILYANT has been named general manager of the Macnick Division at Tulsa, Okla., of the Rockwell Mfg. Co., Pittsburgh, Pa. Mr. Fomilyant, who was district manager for the Meter and Valve Division in Los Angeles, Calif., succeeds W. M. CONNOR, who is being transferred to headquarters at Pittsburgh, supervising sales and production liaison between headquarters and divisional plants and field offices. E. M. CLORAN assumes the post of Los Angeles district manager vacated by Mr. Fomilyant.

PATTERSON FOUNDRY & MACHINE CO., East Liverpool, Ohio, announces the opening of a district sales office at 39 S. Knoxville St., Tulsa, Okla. W. V. C. JACKSON has been named manager.

H. J. FEICHTMANN, sales engineer, has been promoted to the position of district manager of the Heavy Machinery Division, North Central territory, by the Nordberg Mfg. Co., Milwaukee, Wis. Mr. Feichtmann succeeds E. C. Brooks, who has retired. His territory covers northwestern Wisconsin, Minnesota, the Dakotas, Wyoming, and eastern Montana, with headquarters at Milwaukee.

New England

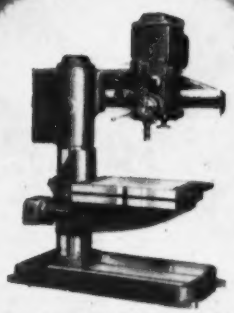
WALTER C. THOMPSON, vice-president in charge of sales for the Torrington Co., Torrington, Conn., has become executive vice-president succeeding ALFRED W. BURG, who has retired after thirty-seven years of service with the company. RAY B. NICHOLS succeeds Mr. Thompson as vice-president in charge of sales. Mr. Nichols was president and general manager of the Torrington Co. of Indiana, South Bend, Ind., a subsidiary. He will now make his headquarters at Torrington but will contine as president of the Indiana company. RODNEY T. DUNLAP, formerly assistant general manager of the Torrington Co. of Indiana, has been promoted to the post of vice-

(*Continued on page 273*)

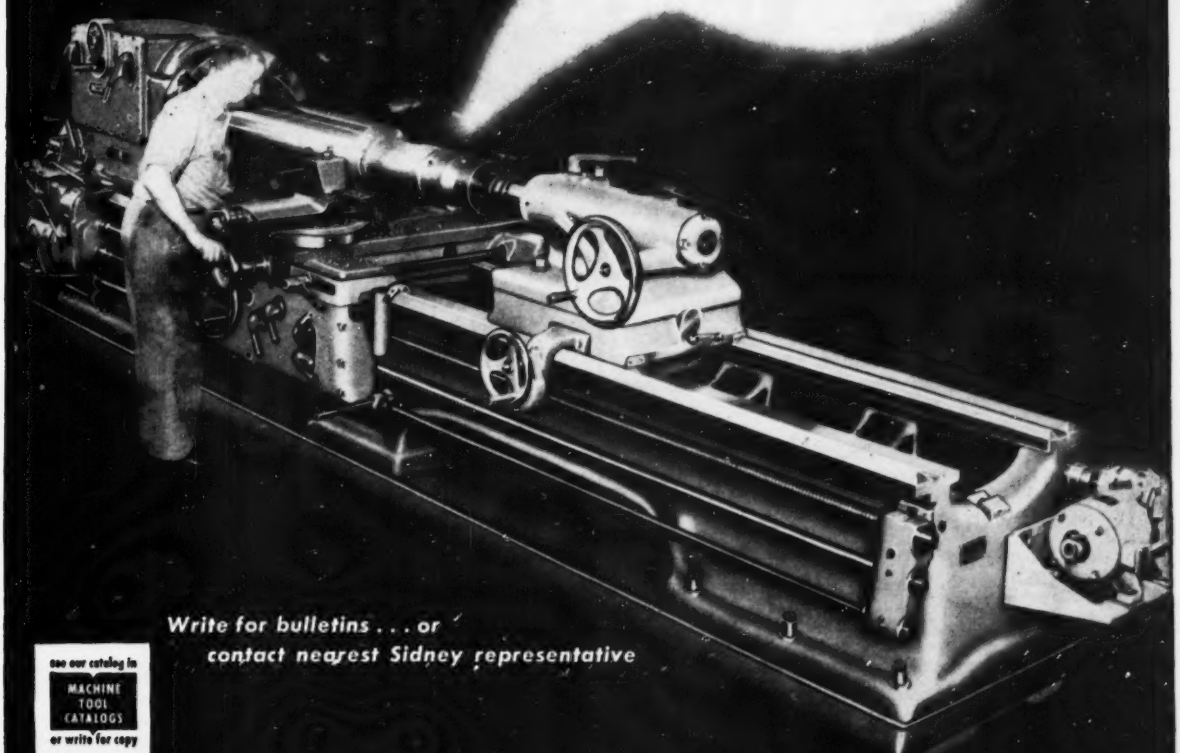
SIDNEY
HEAVY-DUTY LATHES

DESIGNED FOR ACCURACY
●
BUILT FOR LONGER LIFE

Here is a 32-inch Model 16 Sidney Lathe turning columns for 3 and 4-foot sensitive radial drills. Carboloy tools are being used on semi-steel. Speed: 300 feet per min. Photograph taken in plant of Fosdick Machine Tool Co., Cincinnati, Ohio.



FOSDICK RADIAL DRILL



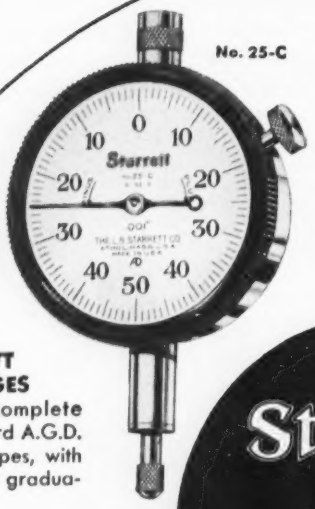
Write for bulletins . . . or contact nearest Sidney representative

see our catalog in MACHINE TOOL CATALOGS or write for copy

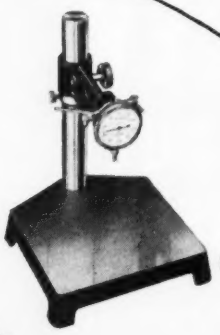
THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

MADE TO STARRETT STANDARDS OF ACCURACY AND PERFORMANCE

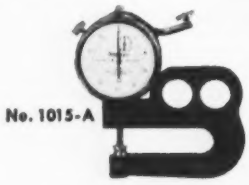


STARRETT DIAL GAGES
Made in a complete range of standard A.G.D. sizes and 54 types, with English or Metric graduations.



STARRETT DIAL COMPARATOR No. 653
With fine vertical adjustment. Base platen 9" x 9⅝". Vertical capacity 9¼". Throat depth 5". Indicator graduated .001".

Starrett DIAL INDICATORS

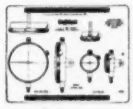


STARRETT PORTABLE DIAL HAND GAGES No. 1015-A and 1015-B
½" and 1" thickness capacities; 2½" throat. Ideal for quickly measuring plywood, rubber, textiles, paper, metal parts, leather, veneer, fabrics, etc.

STARRETT UNIVERAL DIAL BENCH GAGE No. 652
With sliding table and fine adjustment. Capacity 1¾", throat depth 1⅝". Indicator graduated .0005".

WRITE FOR YOUR COPIES

DIAL INDICATOR CATALOG describes and illustrates the complete line with specifications and useful data . . . Address Department D.



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THE L. S. STARRETT COMPANY
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MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
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HACKSAWS, BAND SAWS and BAND KNIVES

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Quality products

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TYPICAL CHEMICAL FINISHES FOR ALUMINUM — 1

Function	Frosted Finish	Base for Paint Coverings	
Process	Caustic Etch	Alrok	Bonderite
Comments	Unless streaking occurs in Step 1, Step 2 can be eliminated To prevent discoloration from usage, protect with clear organic or anodic type finishes	Treatment provides excellent paint adhesion Can be applied by spraying Solution concentrations and process modifications should be checked against Alcoa recommendations	Excellent treatment for use as paint base Can be applied by spraying
Step 1	Caustic Dip* 5 to 10 per cent NaOH solution 1/2 to 1 minute at 150 to 180 deg. F.	Preclean	Preclean
Step 2	Mild Caustic Dip* 2 per cent NaOH solution 2 to 5 minutes at room temperature	Carbonate-Dichromate Dip* 2 per cent sodium carbonate, 0.1 per cent potassium dichromate solution 20 minutes at 140 to 160 degrees F.	Bonderite Dip‡ 7 per cent Bonderite 170, 1 per cent boric acid, 1.5 per cent sodium bifluoride solution 2 to 5 minutes at 180 to 200 deg. F.
Step 3	Cold Water Rinse†	Dichromate Dip* 5 per cent potassium dichromate solution 5 to 10 minutes at 140 to 160 deg. F.	Cold Water Rinse‡
Step 4	Acid Dip‡ 20 to 50 per cent nitric acid solution 3 to 5 minutes at room temperature	Cold Water Rinse†	Parcolene Rinse* 0.1 per cent Parcolene solution 1/2 to 1 minute at 150 to 200 deg. F.
Step 5	Cold Water Rinse†	Dry	Dry
Step 6	Dry		
Suitable Proprietary Compounds			Bonderite 170 and Parcolene: Parker Rust-Proof Co.

*Steel tank
†Wood or steel tank
‡Stainless, or acid-resistant lined tank

MACHINERY'S Data Sheet No. 741, November, 1953 — Compiled by the Reynolds Metals Co.

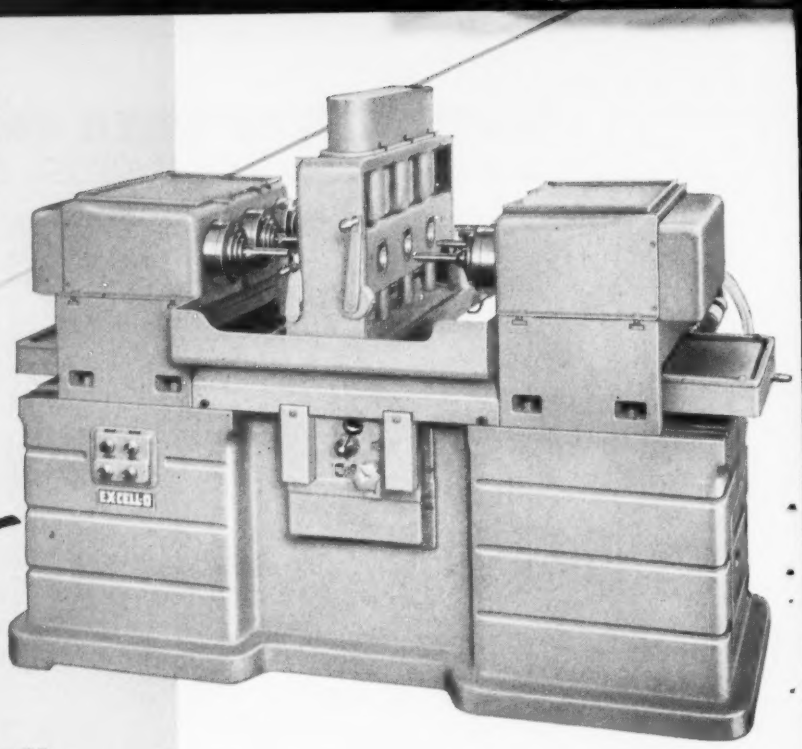
TYPICAL CHEMICAL FINISHES FOR ALUMINUM — 2

Function	Base for Paint Coverings		Base for Electroplating
Process	Alodine	Phosphatizing	Zincate Coating
Comments	Excellent treatment for use as paint base Can be applied by spraying Provides corrosion resistance	Phosphate coating increases paint bond appreciably Can be applied by spraying Advantages: Minimum equipment required; Inexpensive; Room temperature process	For bright electroplated finishes, cleaning treatments should be preceded by polishing operations Zinc coating will serve to eliminate seizing in threaded sections and to protect aluminum against electrolytic corrosion
Step 1	Preclean	Preclean	Mild Alkaline Clean or Vapor Degrease
Step 2	Alodine Dip‡ 10 gallons Alodine No. 100, 18 pounds Alodine powder No. 2 per 90 gallons of water 1 to 2 minutes at 110 to 120 degrees F.	Acid Dip‡ 5 to 10 per cent phosphoric acid solution 4 to 6 minutes at room temperature	Alkali Clean
Step 3	Cold Water Rinse†	Cold Water Rinse†	Zincate Bath* 55 per cent NaOH, 10 per cent ZnO solution 2 to 3 minutes at room temperature
Step 4	Deoxylyte Dip* 0.03 per cent Deoxylyte solution 1/2 minute at 100 to 120 degrees F.	Dry	Thorough Cold Water Rinse†
Step 5	Dry		Dry
Suitable Proprietary Compounds	Alodine and Deoxylyte: American Chemical Paint Co.		

*Steel tank
†Wood or steel tank
‡Stainless, or acid-resistant lined tank

MACHINERY'S Data Sheet No. 742, November, 1953 — Compiled by the Reynolds Metals Co.

Style 17 Ex-Cell-O Precision Boring Machine equipped with new, inbuilt motor spindles for semifinish and finish-boring of wrist pin holes in automotive pistons.



Vibration-Free Boring

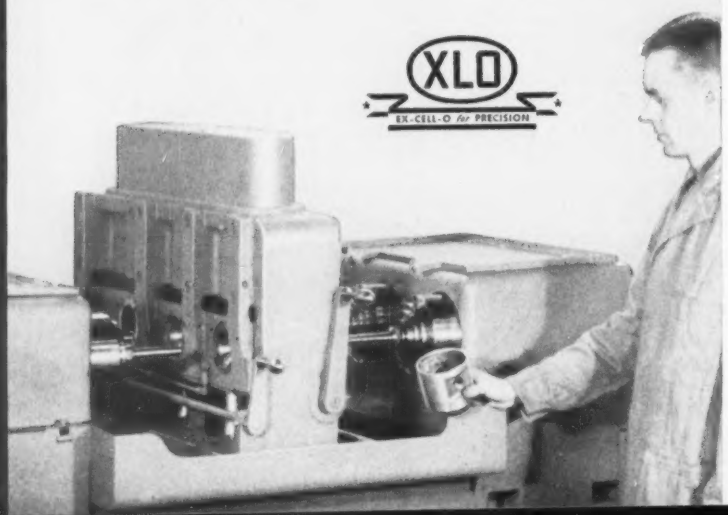
NEW INBUILT-MOTOR SPINDLES ON EX-CELL-O PRECISION BORING MACHINE ASSURE FAST, ACCURATE FINISHING OF PISTON PIN HOLES

Wrist pin holes in automotive pistons are given exceptionally fine surface finish by this Style 17 Precision Boring Machine equipped with inbuilt-motor spindles. Diameters are held within .0003″ total tolerance. The inbuilt motor positively eliminates any vibration that might originate in belts and pulleys.

The thin walled parts are held firmly, yet without distortion in a fixture which provides perfect alignment for bores through both bosses. Interchangeable locators are provided to accommodate two sizes of pistons. This machine both semifinishes and finish-bores the pin holes. Production rate is high.

For further information on the many uses to be made of Ex-Cell-O Precision Boring Machines, see your local Ex-Cell-O representative or write today for Bulletin 31205.

The machine table feeds to the left for semifinish-boring, then to the right for finish-boring, assuring uniform stock removal for the finishing cut. New inbuilt-motor precision boring spindles are rigid and smooth running. Coolant is manifolded through the covers on both sides of the pistons.



EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS • DAIRY EQUIPMENT
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS

53-21

president and general manager of this subsidiary, while JOHN A. TOTH, chief engineer, has been promoted to assistant general manager. WALTER FISHER, who was assistant chief engineer, now becomes chief engineer of the division.

BILLINGS & SPENCER CO., Hartford, Conn., manufacturer of hand tools, has purchased the PECK, STOW & WILCOX CO., Southington, Conn. Peck, Stow and Wilcox Co., established in 1785, manufactures mechanics' hand tools and machines and tools for the sheet metal-working industry, using the trade names "Pexto" and "Worth."

ERNEST NUBER has been named sales manager of the Instrument Division of the Bristol Co., Waterbury, Conn. Mr. Nuber joined the sales engineering organization of the company in 1929, and since 1948 has been manager of the application engineering department.

MILTON D. THALBERG has been elected president of the International Machinery Co., New Haven, Conn. This company covers the lower New England area, and was recently appointed distributor for the Kurt Orban Co., New York City.

AMERICAN NICKELOID CO., Peru, Ill., manufacturer of pre-plated metals in sheets and coils, announces that its New England sales office has been moved from Beverly, Mass., to 250 Boylston St., Boston 16.

GEORGE A. DAVIS has joined the Alloy Tube Division, Union, N. J., of the Carpenter Steel Co., Reading, Pa., in the capacity of New England sales representative. His territory will include Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.

New York and New Jersey

DR. RAYMOND W. MCNAMEE has been named manager of research administration by the Union Carbide and Carbon Corporation, New York City. He will help coordinate the research activities of all of the Corporation laboratories. Dr. McNamee, who joined the Corporation's chemical research organization in 1933, has been superintendent of the research and development department of the Carbide and Carbon Chemicals Co., a Division of Union Carbide at South Charlestown, W. Va., since 1950. He will be succeeded in this position by DR. FRANKLIN JOHNSTON. Dr. Johnston was formerly assistant director of research for this company, this position now being filled by DR. HENRY C. CHITWOOD.

AMERICAN WELDING SOCIETY, New York City, recently elected the following officers for 1953-1954: President, FRED L. PLUMMER, director of engineering, Hammond Iron Works, Warren, Pa.; first vice-president, J. H. HUMBERSTONE, vice-president, Air Reduction Co., Inc., New York City; second vice-president, J. J. CHYLE, director of welding research, A. O. Smith Corporation, Milwaukee, Wis.; and treasurer, RUSSELL S. DONALD, president, R. S. Donald, Inc., New York City.

Fred L. Plummer, who has been re-elected president of the American Welding Society

GENERAL ELECTRIC CO., Schenectady, N. Y., announces the establishment of a specialty control department at the Schenectady Works. DR. LOUIS T. RADER has been appointed general manager of the department, which will be responsible largely for industrial electronic, regulator, and aircraft control equipment. Appointed to Dr. Rader's staff are K. N. BUSH, manager of manufacturing, and H. L. PALMER, manager of engineering.

ALBERT E. MERWIN has been appointed sales and technical service manager of the Lurium Alumium Division of Fromson Orban Co., Inc., New York City, importer of nonferrous metals. Mr. Merwin was formerly associated with Kaiser Aluminum & Chemical Sales, Inc.

HOWARD K. SEGERLIND has been appointed to the can machinery sales office in New York City by the E. W. Bliss Co., Canton, Ohio. Mr. Segerlind has served the company for six years as an engineer specializing in can machinery.

JAMES E. BUTLER has been appointed manager of product sales of the Franklin Balmar Corporation, Baltimore, Md. Mr. Butler's offices are at 60 E. 42nd St., New York City.

RAYMOND A. THON was recently appointed director of quality control at Rochester Products, Division of General Motors Corporation, Rochester, N. Y.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces an addition to its present plant at 203 Westside Ave., Jersey City, N. J., thus increasing the steel service facilities of the New York area steel service plant about 50 per cent. The total floor area of the enlarged plant is about 355,000 square feet.

ROY J. GAVIN has been elected vice-president of the Irvington Varnish & Insulator Division, Irvington, N. J., of the Minnesota Mining & Mfg. Co., St. Paul, Minn. Mr. Gavin, who was sales manager of the sound recording tape division at St. Paul, will move to the Division's offices at Irvington.

IPSEN INDUSTRIES, INC., Rockford, Ill., manufacturers of automatic heat-treating equipment, have announced the opening of a new sales and service division at 146 E. Front St., Plainfield, N. J. ALFRED E. STONE will be sales engineer at this office, while JOHN KEEGAN will be service engineer.

S-P MFG. CORPORATION, Cleveland, Ohio, manufacturer of power chucks and air and hydraulic cylinders, has appointed the BEVERLY D. SMITH CO., 29 N. Dean St., Englewood, N. J., as representative in Manhattan, Long Island, and southern New York State.

Ohio

GEORGE W. CURTIS, Milwaukee, division sales manager of the Timken Roller Bearing Co., Canton, Ohio, recently retired after thirty-three years of service with the company. Mr. Curtis plans to live in Fort Myers, Fla., where he has formed a new company, Curtcraft, Inc., a concern to be allied with the farm implement field. The Timken Roller Bearing Co. also announced at this time that the Milwaukee Industrial Sales Division responsibility has been divided among three district offices in Milwaukee, Wis., Minneapolis, Minn., and Moline, Ill. ROBERT MORGAN, district manager at Moline, continues in that post, while FLOYD HARTSHORN is now district manager at Milwaukee. Mr. Hartshorn has been in this sales office since 1939 except for the period of his Navy service. DONALD VAN ORMAN has been appointed district manager at Minneapolis. He was a sales engineer there at the time of his promotion.

E. W. BLISS CO., Canton, Ohio, announces the acquisition of the DIE SUPPLY CO., 1400 Brookpark Road, Cleveland, Ohio, manufacturer and distributor of diemakers' supplies

for the metal-working industry. Newly elected officers of the company are as follows: President, H. U. HERRICK; executive vice-president, J. H. TREDINNICK; treasurer, W. H. GARRISON; and secretary, F. J. DE LORME. These four officers hold corresponding positions in the Bliss concern. Former Die Supply Co. officials who will continue with the organization include JOHN R. FITZSIMMONS, founder, who will remain as chairman of the board; WARREN FITZSIMMONS, former president, who will assume the duties of factory manager; and CARL J. THEKEN, former comptroller, who will become assistant secretary and assistant treasurer.

MOTCH & MERRYWEATHER MACHINERY CO., Cleveland, Ohio, distributor and manufacturer of precision machine tools, announces that it will produce the "Triple-M" power unit and a series of garden and lawn implements. A new division has been created to be known as the "Triple-M" Division, with ELMER W. MATTICK as manager. Production facilities are separately located on Wilson Mills Road in Chester Township.

DWIGHT H. LORY has been named assistant manager of the Texrope drive section at Plant No. 2 in Cincinnati, Ohio, by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Mr. Lory was formerly assistant to the general manager of the Norwood plants.

FRED R. BAYNE was recently promoted to the position of chief engineer of the Alten Foundry & Machine Works, Inc., Lancaster, Ohio, while WILLIAM A. MORRIS, JR., has joined the concern, assuming the post of product development engineer.

THURMAN G. THURSTON has been appointed representative in the Cleveland, Ohio, territory by the Selas Corporation of America, Philadelphia, Pa. Mr. Thurston will have his office at 1241 Commonwealth Ave., Cleveland.

PAUL W. BRANNON, manager of manufacturing at the Pesco Products Division, Bedford, Ohio, of the Borg-Warner Corporation, Chicago, Ill., was recently promoted to the position of vice-president of manufacturing.

E. AUSTIN SCHOLIN was recently named Kaydon bearing representative in Ohio by the Kaydon Engineering Corporation, Muskegon, Mich. His headquarters will be at 3769 E. 145th St., Cleveland, Ohio.

BEN SNYDER has been named sales engineer in the Dayton, Ohio, office by the E. W. Bliss Co., Canton, Ohio. Mr. Snyder, who joined the company in 1945, was with the Bliss Toledo Service Division.

STERLING ELECTRIC MOTORS, INC., Los Angeles, Calif., has moved its Cincinnati, Ohio, office to 2904 Woodburn Ave., Cincinnati 6, Ohio. JOHN F. CURD has been appointed district manager.

KURT ORBAN CO., INC., New York City, announces the removal of its Cleveland, Ohio, office and service center to larger quarters at 1256 E. 12th St.

Pennsylvania and Maryland

FRANK L. SNYDER, vice-president of the Westingnouse Electric Corporation, Pittsburgh, Pa., has reassumed management of the Corporation's Transformer Division at Sharon, Pa. He was manager of this Division from 1949 to 1951, but more recently was assigned to the staff of the executive vice-president in charge of defense products. Returning to Sharon as vice-president and general manager, Mr. Snyder succeeds CHRIS H. BARTLETT, who is on leave attending the Harvard School for Advanced Management.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces the following sales department appointments: WILSON E. GARDNER, formerly Boston branch manager, has been promoted to manager of the New York branch; HENRY A. STURM, assistant branch manager at Boston, has assumed the post of branch manager there; and ALFRED A. COMPANION, sales service engineer, has become assistant branch manager at Boston. HAROLD BARLOW, who was New York branch manager, will become special sales consultant for this branch.

WESTINGHOUSE ELECTRIC CORPORATION announces that its Middle Atlantic district, with headquarters in Philadelphia, Pa., and sixteen offices throughout the area, has been reorganized to become the Atlantic Region. E. W. LOOMIS, who was district vice-president in Philadelphia, has been named vice-president of the new Region. T. P. JONES, formerly Philadelphia branch manager, will serve as manager of the new Philadelphia district, while J. W. MAGEE, who was Baltimore branch manager, has been appointed manager of the new Chesapeake district with headquarters in Baltimore, Md.

PITTSBURGH GEAR CO., Pittsburgh, Pa., subsidiary of the Brad Foote Gear Works, Inc., Cicero, Ill., will move to larger quarters within a few months. At present, the company is located at 27th and Smallman Sts., but will move to a building on Neville Island formerly occupied by the Cementstone Corporation, with a floor space of 33,000 square feet.

ROCKWELL MFG. CO., Pittsburgh, Pa., has leased a building at 300 N. Lexington Ave., Pittsburgh, Pa., in order to expand its Delta power tool manufacturing operations. The building was formerly occupied by the Lawson Mfg. Co., and is adjacent to Rockwell's Homewood plant.

G. CLYMER BROOKE, vice-president of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has been elected executive vice-president of the company.

JOHN W. PENNINGTON has been named manager of the new technical department of the Metal Products Division, Baltimore, Md., of Koppers Co., Inc., Pittsburgh, Pa. Mr. Pennington was executive engineer of the Division at the time of his appointment.

Canada

EX-CELL-O CORPORATION, Detroit, Mich., has formed a wholly owned subsidiary, Ex-Cell-O Corporation of Canada Ltd., and has acquired the assets of HENRY POWER TOOLS, LTD., and CRAFTOOLS, LTD., both of 120 Weston St., London, Ontario, Canada. These companies are presently engaged in light and medium heavy machining work, miscellaneous jobbing, foundry work, and a power tools business. The new subsidiary will continue the operations with the exception of the power tools business which has been sold to Strongridge, Ltd., also of London, Ontario, and will also start producing some of the standard Ex-Cell-O products. JOHN GILCHRIST, who was president of the Canadian concerns, will continue as an officer and managing director of the new organization.

W. ALEXANDER MCCUNE, JR., who was an abrasive engineer in northern New Jersey for the Norton Co., Worcester, Mass., has been appointed general sales manager of the Norton Co. of Canada Ltd., succeeding C. W. FELL. Mr. Fell, who is relinquishing his duties as general sales manager because of ill health, will become an abrasive engineer in the Toronto area. WINTON A. VAGEDES is assuming Mr. McCune's former territory in New Jersey.

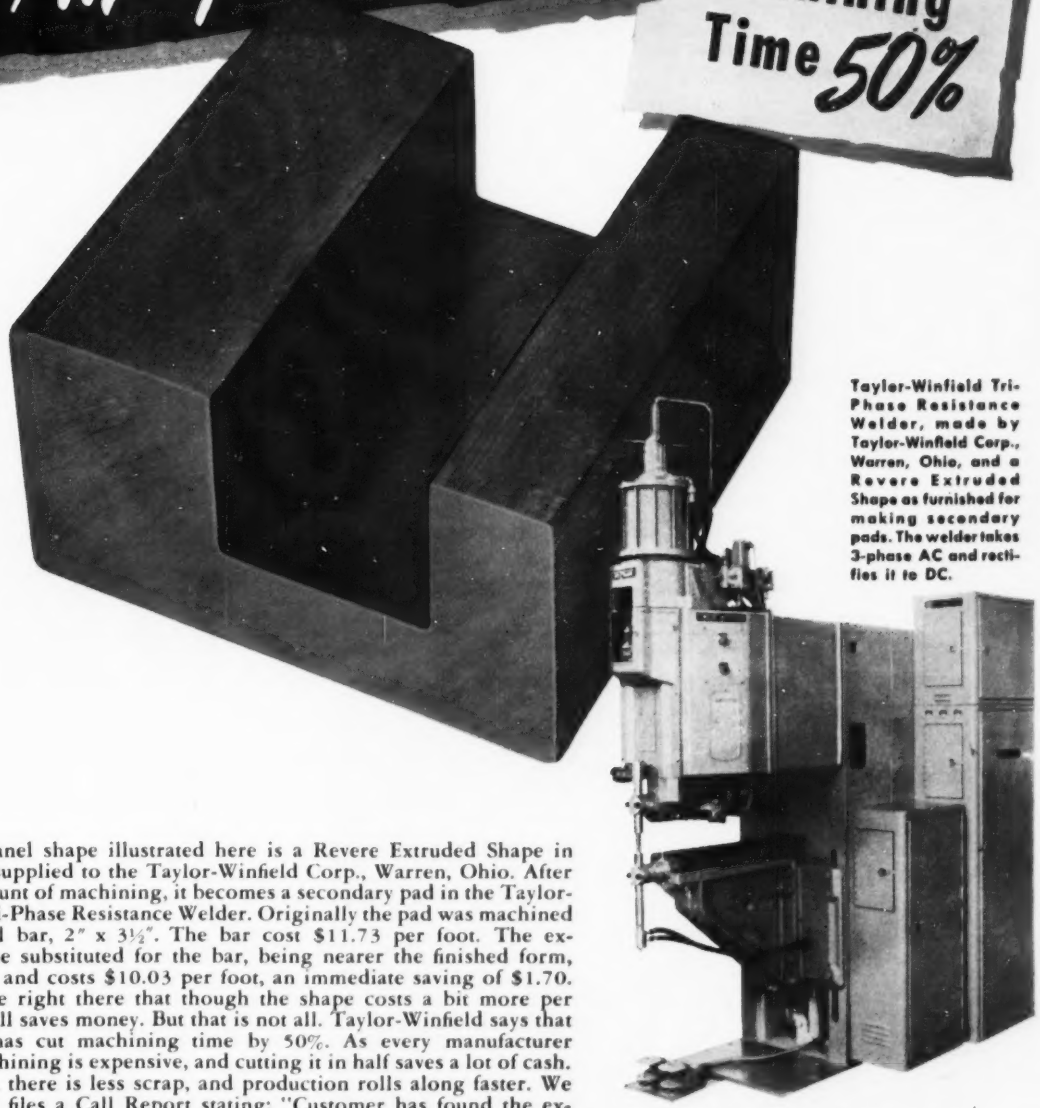
* * *

Film on the Opportunities in Mechanical Engineering

A motion picture film depicting job opportunities in the field of mechanical engineering has been produced by the School of Engineering, Michigan State College, East Lansing, Mich. Aimed at high school groups, the film includes scenes of training on the M. S. C. campus and of professional engineers at work in industry. The twenty-minute color film is available without charge.

REVERE
Extruded Shape SAVES *$1.70 per foot...*

CUTS Machining Time *50%*



Taylor-Winfield Tri-Phase Resistance Welder, made by Taylor-Winfield Corp., Warren, Ohio, and a Revere Extruded Shape as furnished for making secondary pads. The welder takes 3-phase AC and rectifies it to DC.

● The channel shape illustrated here is a Revere Extruded Shape in copper, as supplied to the Taylor-Winfield Corp., Warren, Ohio. After a small amount of machining, it becomes a secondary pad in the Taylor-Winfield Tri-Phase Resistance Welder. Originally the pad was machined out of solid bar, 2″ x 3½″. The bar cost $11.73 per foot. The extruded shape substituted for the bar, being nearer the finished form, weighs less and costs $10.03 per foot, an immediate saving of $1.70. You can see right there that though the shape costs a bit more per pound, it still saves money. But that is not all. Taylor-Winfield says that the shape has cut machining time by 50%. As every manufacturer knows, machining is expensive, and cutting it in half saves a lot of cash. In addition, there is less scrap, and production rolls along faster. We have in our files a Call Report stating: "Customer has found the extruded section very satisfactory, and bases his machining time-saving on production runs and not estimates."

Credit for this fine achievement has to be shared by a number of people, both in Taylor-Winfield and in Revere. Our Sales and Technical Advisory staffs collaborated closely with the customer's engineering, production and purchasing personnel. Everybody considered all angles, and worked out this money-saving plan.

So we suggest that if you are doing any extensive machining of copper and copper alloys, or aluminum alloys, it would be a good idea to look into Revere Extruded Shapes. They might offer you important economies. We will be glad to consult with you. Just get in touch with the nearest Revere Sales Office.

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COPPER AND BRASS INCORPORATED

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y. Sales Offices in Principal Cities, Distributors Everywhere.

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For more information on products advertised, use Inquiry Card, page 261

Obituaries

HERBERT A. GOTTSCHALK, sales management executive of the Kearney & Trecker Corporation, Milwaukee, Wis., machine tool manufacturer, died on September 26 after a short illness. He was assistant to the vice-president in charge of sales, in which capacity he directed the sales office administration and export sales. Mr. Gottschalk had been with the company for thirty years and a member of its management group since 1947. He is survived by his wife and three brothers.

CHESTER BROWN HAMILTON, president and general manager of the Hamilton Gear & Machine Co., Ltd., Toronto, Ontario, Canada, died on October 5 at the age of sixty-nine years. Mr. Hamilton was most active in the field of gear work. During World War II, he developed a substitute bronze for worm gears to conserve tin, offering to industry the free rights to utilize the analysis. He was a life member of the American Society of Mechanical Engineers and was instrumental in forming the Ontario section of this Society. Mr. Hamilton is survived by his wife, a son, and two daughters.

HERBERT D. TIETZ, manager of sales of the Inco nickel alloys department of the International Nickel Co., Inc., New York City, died suddenly on October 11 at the age of fifty-five years. Mr. Tietz, who was a resident of Maplewood, N. J., was associated with the company since 1931. He is survived by his wife and a daughter.

HERBERT L. BROWN died suddenly at his home in Bloomington, Ill., on September 30 at the age of eighty-five years. Mr. Brown represented MACHINERY in the Midwestern States for many years during the early period of this technical journal. He had a wide acquaintanceship among the pioneers of the machine tool industry.

JOHN O. LARSON, director and executive vice-president of the Fischer & Porter Co., Hatboro, Pa., died on September 18 at the age of thirty-nine years. Mr. Larson was widely known as a specialist in industrial instrumentation. He was a member of the Instrument Society of America.

Coming Events

NOVEMBER 9-13—MONTREAL TOOL AND INDUSTRIAL EQUIPMENT SHOW, associated with Montreal Materials Handling Show, to be held at the Show Mart, Berri Square, Montreal, Canada. For further information, write to E. M. Wilcox, Manager, 19 Melinda St., Toronto, Canada.

JANUARY 25-28, 1954—PLANT MAINTENANCE AND ENGINEERING SHOW to be held at the International Amphitheater, Chicago, Ill. For further information write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

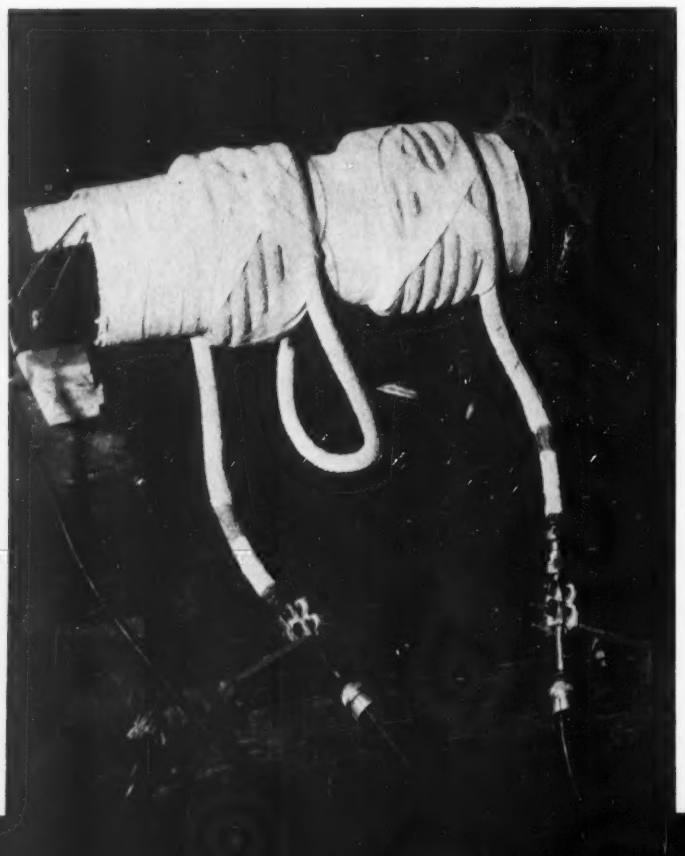
APRIL 26-30, 1954—Tenth Biennial Industrial Exposition of the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at Convention Center in Philadelphia, Pa. Executive secretary, Harry E. Conrad, 10700 Puritan Ave., Detroit 21, Mich.

MAY 4-7, 1954—National spring technical meeting of the AMERICAN WELDING SOCIETY to be held at the Hotel Statler, Buffalo, N. Y. National secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

JUNE 7-10, 1954—Sixth National Plastics Exposition sponsored by the SOCIETY OF THE PLASTICS INDUSTRY, INC., at the Public Auditorium in Cleveland, Ohio. Chairman, P. H. Grunnagle, Society of the Plastics Industry, Inc., 67 W. 44th St., New York 18, N. Y.

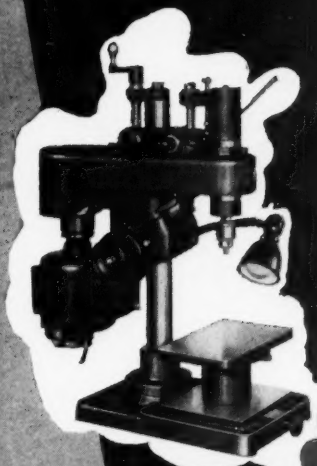
* * *

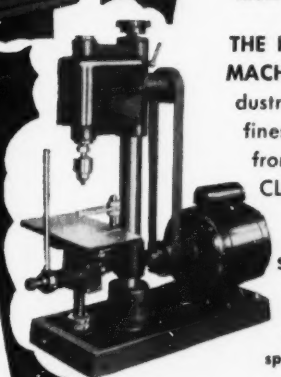
Over 2200 abstracts of British welding patents have been added to the A. F. Davis Welding Library located at Ohio State University, Columbus, Ohio. With this addition, approximately 15,000 patents have now been classified there. The library is available to industrial engineers, designers, and technicians interested in the various forms of welding.



Welded areas of large-diameter molybdenum steel pipe sections employed in high-pressure steam lines are stress-relieved by induction heating. The coil, a low-frequency water-cooled conductor, is made of Titeflex metal hose. The flexibility of the conductor permits it to be unwound and rewound repeatedly without work-hardening or deteriorating. Both thermal and electrical insulation are provided by an asbestos stocking around the conductor. Water enters through a fuse coupling, which automatically cuts off the current should a water-flow failure occur, thus preventing the conductor from burning.

Hamilton PRECISION DRILLING MACHINES • TAPPING MACHINES GEAR HOBBERS





If your work can be done within the framework of the specifications of these machines you can not buy a more precise tool than one bearing the Hamilton nameplate.

THE HAMILTON VARIMATIC® SUPER SENSITIVE DRILLING MACHINE is designed for the accurate production-drilling of small holes in all drillable materials. Its capacity ranges from .004" to .3125" and its spindle speeds, which range from 840 to 9300 R.P.M., are infinitely variable.

CLEARANCES Center of chuck to column..... 5"
Round table to chuck.....10"

THE HAMILTON NO. 00 PRECISION GEAR HOBBER is a machine of extra precision and extra rigidity. It is used for the generation of spur gears and pinions to 2" outside diameter of the workpiece. Alignment and trueness of the work spindle and hob spindle is held to within .0002". Accumulative error is regularly held to .0002" or less.

THE HAMILTON NO. 1 PRECISION GEAR HOBBER generates spur and spiral gears, worms and worm gears, splined shafts, gear sectors and pinions of extra accuracy and at high production speeds. The alignment and trueness of the work spindle and hob spindle is held to within .0002". Accumulative error is regularly held to .0002" or less. Maximum workpiece diameter is 6".

THE HAMILTON SUPER SENSITIVE, SMALL HOLE TAPPING MACHINE is designed and built to serve the precision industries. Its tapping capacity is from the smallest and finest tap to 10/32 inclusive. Its spindle speeds range from 1200 to 2600 R.P.M.

CLEARANCES Center of chuck to column....3¼"
Round table to chuck.....4"

Selection of a Hamilton tool, even though your present work does not require Hamilton accuracy, is a wise and far-sighted decision, for Hamilton's production potential and "reserve of accuracy" permits you to face possible specification changes with complete confidence.

Prepare now to meet restless competition in the months ahead. Equip your plant for precision production and be confident that your competition can not deliver more.

Mail the coupon today for complete FREE information on any or all of the Hamilton machines shown.

THE *Hamilton* TOOL COMPANY
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THE HAMILTON TOOL COMPANY
HAMILTON, OHIO 5336

Gentlemen: Please send FREE literature as checked.

Hamilton No. 1 Precision Gear Hobber	☐	Varimatic Drilling Machine	☐
Hamilton No. 00 Precision Gear Hobber	☐	Hamilton Tapping Machine	☐

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City and State _____

New Books and Publications

TIMING ENGINEERING. By Myrten G. Saake. 243 pages, 6 by 9 inches. Published by the Ribble Engineering Co., 74-80 Montgomery St., Jersey City 2, N. J. Price $5.

The purpose of this text is to present a complete reference source on industrial timers—their basic design, construction, and applications. Timers are covered in their simplest to most complex form, illustrated by circuit diagrams. Chapter headings are as follows: Industrial Timing Devices; Synchronous Motor-Driven Repeating Cycle Timers; Synchronous Motor-Driven Automatic Reset Timers; "Cycl-Flex" Automatic Reset Timer; "Timoflex" Automatic Reset Timer; Multiple Circuit Automatic Reset Timers; Direct-Current Timers; "Microflex" Automatic Reset Counters; and Timer Types other than Synchronous Motor-Driven.

WELD STANDARDS. Published by the Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, Ohio. 18 pages, 8 1/2 by 11 inches. Price, $1 (paper-bound).

This set of weld standards is based on procedures developed by the Lincoln Electric Co. and the weld symbols of the American Welding Society to enable engineers to communicate information for cost and quality control of welding operations. The standards are available on tracing paper so that they can be blueprinted or otherwise reproduced. Standards have been prepared for manual welding of butt, fillet, lap, and corner welds in all positions in both plate and sheet metal.

OPPORTUNITIES IN MACHINE SHOP TRADES. By Benjamin J. Stern. 95 pages, 5 by 8 inches. Published by Vocational Guidance Manuals, Inc., 45 W. 45th St., New York 36, N. Y. Price, $1 (paper-bound).

This book is designed to aid young people who want to get started in the field of machine shop trades, and comprehensive information is provided to this end. For handy reference basic machine shop occupations are analyzed.

AMERICAN STANDARD SAFETY CODE FOR MECHANICAL POWER-TRANSMISSION APPARATUS (ASA B15.1—1953). 49 pages, 5 1/4 by 7 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.

AMERICAN STANDARD CAST-IRON SCREWED DRAINAGE FITTINGS (ASA B16.12—1953). 16 pages, 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.

Awards of the American Standards Association

Ralph E. Flanders, United States senator from Vermont, received the 1953 Howard Coonley Gold Medal for "service in advancing the national economy through voluntary standards" at the annual award luncheon meeting of the American Standards Association, held on October 21 at the Waldorf-Astoria in New York City. Senator Flanders is a past president of the American Society of Mechanical Engineers and of the National Machine Tool Builders' Association, and a former vice-president of the American Engineering Council. Prior to being elected senator in 1946, he was president of the Jones & Lamson Machine Co., Springfield, Vt. At one time he was an associate editor of MACHINERY. Roger E. Gay, president of ASA, made the presentation.

At the same luncheon, Colonel Perry L. Houser, general supervisor of manufacturing standards research, International Harvester Co., Chicago, Ill., received the Standards Medal, which is awarded annually for leadership in the actual development and application of standards.

John Henderson

(Left) United States Senator Ralph E. Flanders, who has been awarded the Howard Coonley Gold Medal; (right) Perry L. Houser, recipient of the Standards Medal

A New Source of Iron Ore

The International Nickel Co. of Canada, Ltd., recently announced it was undertaking the production of by-product iron ore from nickel ores. Construction of a $16,000,000 plant has begun as the first unit in an operation which will ultimately yield about 1,000,000 tons of high-grade iron ore a year, in addition to nickel.

The new plant will supply iron ore higher in grade than any now produced in quantity in North America. Containing at least 65 per cent iron natural and less than 2 per cent silica, this ore will command a premium price for direct use in open-hearth and electric furnace steel production in Canada and the United States. By comparison, ore from the famed Mesabi pits of Minnesota contains 51.5 per cent iron natural. The North American steel industry is presently largely dependent on imports from such countries as Brazil, Venezuela, Sweden, and Liberia for its requirements of ore as high in grade as Inco will produce. This recently developed process may open the way for increased recovery of other elements.

* * *

Origin of Nickel Silver

The ancient Chinese were the first to produce the alloy known today as nickel silver. They called this metal —which is a combination of nickel, copper and zinc—"paktong," a word signifying "white copper." The alloy was later referred to as German silver, and finally as nickel silver.

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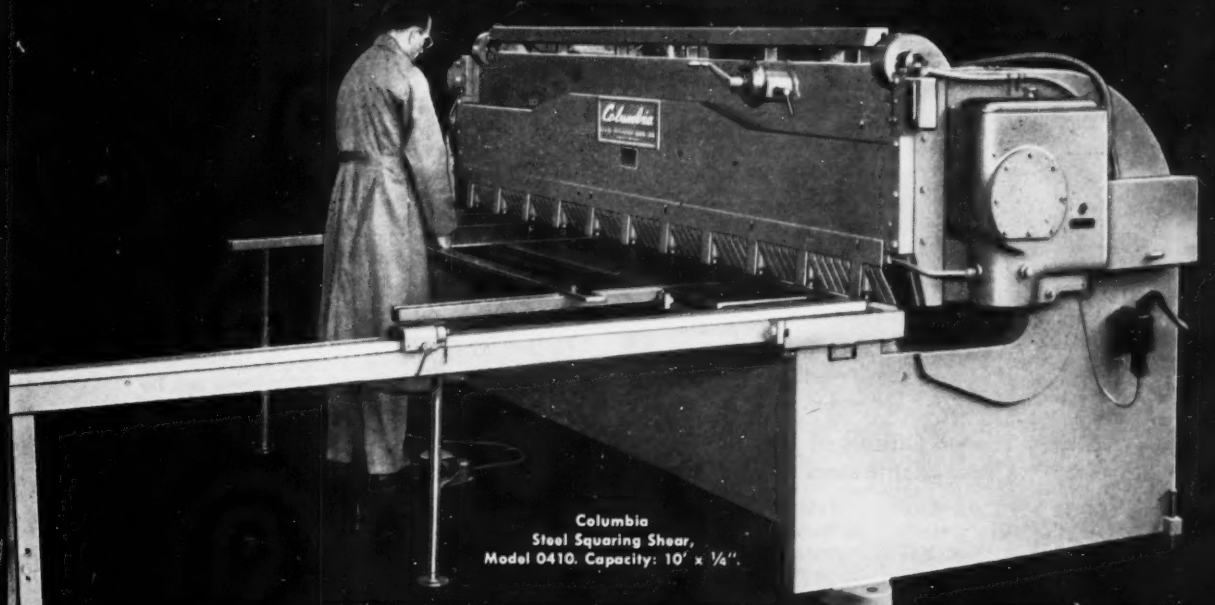
The Blade Clearance Indicator, for example, makes blade clearance adjustment an "operator function." Simplifies and speeds quality shearing without the assistance of supervisory personnel. This new-found ease of making blade adjustments leads to accurate blade clearances regardless of how frequently material specifications change.



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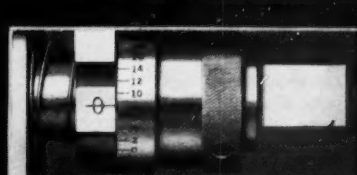

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Recently Elected Officers of the American Machine Tool Distributors' Association

More than two hundred and fifty persons attended the twenty-ninth annual meeting of the American Machine Tool Distributors' Association held at the Greenbrier, White Sulphur Springs, W. Va., September 14 and 15. The following officers were elected for the ensuing year: President, Thomas R. Rudel, president, Rudel Machinery Co., Inc., New York City; vice-president, R. A. Vidinghoff, president and treasurer, Machinery Associates, Inc., Wynnewood, Pa.; second vice-president, Henry R. Hanson, Wm. K. Stamets Co., Cleveland, Ohio; and secretary-treasurer, J. F. Owens, Jr., J. F. Owens Machinery Co., Syracuse, N. Y.

Members of the executive committee who were elected for the terms expiring in 1956 are: Frank H. Habicht, Marshall & Huschart Machinery Co., Chicago, Ill.; Art C. Evered, Hallidie Machinery Co., Inc., Seattle, Wash.; and N. W. Caldwell, Wigglesworth Machinery Co., Cambridge, Mass. To fill the unexpired term on the committee of Mr. Vidinghoff, the newly elected vice-president, is C. J. Anderson, Anderson Machine Tool Co., St. Paul, Minn.

Special tribute was paid during the business sessions to the late Alexander G. Bryant, president of the Bryant Machinery & Engineering Co. Mr. Bryant was president of the Association 1937-1939.

Ceramic Coating for Magnesium

First announcements of the development of the HAE electrolytically applied ceramic coating for magnesium were made in May, 1951. HAE is named for Harry A. Evangelides, discoverer of the process. For the last eleven years he has been a chemical engineer with Army Ordnance. In October, 1952, Brooks and Perkins made the first installation large enough to handle production lots of magnesium parts, and has since treated parts for many companies. These parts have been mostly machined castings for military usage. Not until this spring was the process declassified.

HAE finish can be applied to all magnesium alloys, including the rare earth alloys. It is refractory and has excellent corrosion, abrasion, and heat resistance. The coating is an excellent paint base, and tests and operating conditions prove it superior to other treatments for magnesium.

The coating is typically 0.001 inch thick. It is non-metallic, very hard, and adherent. The solution used is alkaline; chemicals used are potassium hydroxide, aluminum hydroxide, trisodium phosphate, potassium, chloride, and potassium manganate. The process involves the use of an isolated current source, and is based on the use of 15 amperes per square foot for a treatment time of approximately sixty minutes.

HAE finish, like most others, has excellent properties for many applications but is not suitable for others. For instance, HAE is a very hard abrasion-resistant refractory ceramic coating. No coating with this property has good elastic properties. Like all ceramic coatings, it has limitations where rough handling is a requirement, or where a sheet-magnesium part will be subjected to flexing. Magnesium panels of 0.025-inch thickness, HAE-coated, can be bent as much as 160 degrees and straightened without apparent damage to the coating on the tension side. However, the coating on the compression side is substantially removed by this treatment.

* * *

Propeller Blade Forged from Titanium

What is believed to be the largest titanium alloy die forging made to date is a giant 100-inch long propeller blade forged by the Ladish Co., Cudahy, Wis., for a special project of the United States Air Force. It was designed by the Hamilton Standard Division, United Aircraft Corporation, and is forged from Titanium Metals Corporation's high-strength titanium alloy Ti-140-A.

POTTER & JOHNSTON *Engineering*

HERE

PAYS OFF

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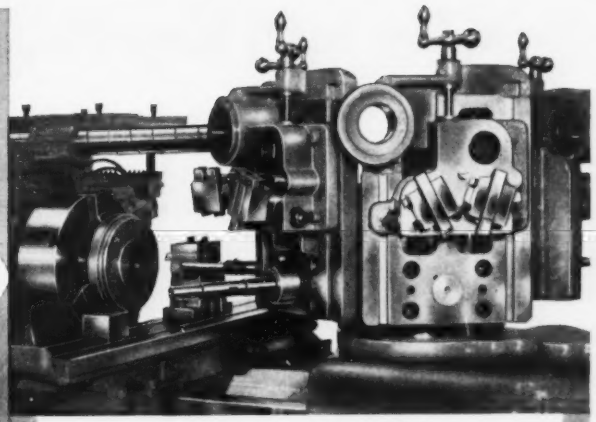
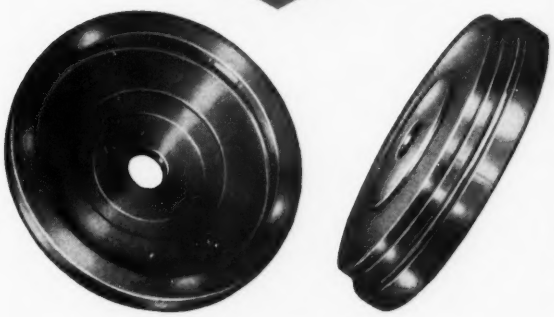
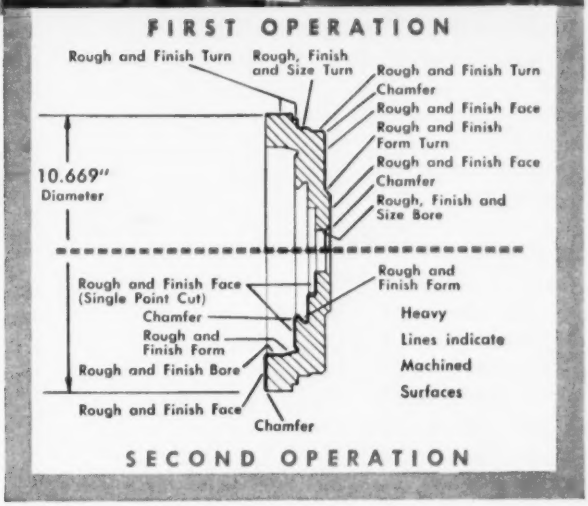




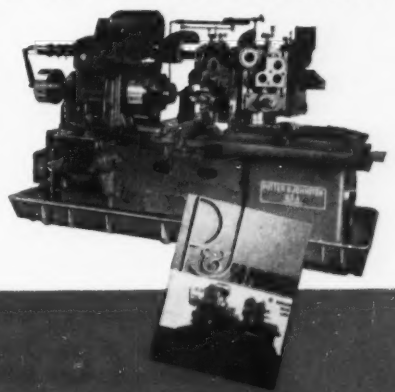
MALLEABLE IRON FLYWHEEL



YOU'LL PRODUCE MORE PIECES MORE ACCURATELY at LOWER COST with P&J TOOLING on a P&J AUTOMATIC

Tooling expertly engineered to the job by Potter & Johnston Specialists assures the best possible combination of machining operations and sequence for fast, accurate, low cost production. Unnecessary handling is eliminated; combined cuts minimize machining time. And when P&J Tooling is put to work on an accurate, powerful, versatile P&J Automatic Turret Lathe — like the 5D Power-Flex shown here — the result is really profitable production on even your toughest jobs.

For complete information, send today for your copy of the 5D Power-Flex Bulletin No. 131 — and ask the P&J Tooling Engineers to submit recommendations based on your prints or sample parts.



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Need low cost, long life, good oil retention?

here's how manufacturers of textile machinery assure them with NEEDLE BEARINGS

Leading manufacturers of roving and spinning frames, looms, knitting machines, sewing machines, top rolls, spindles and many other types of textile machinery and accessories specify Needle Bearings because of their low initial cost and long service life.

Torrington Needle Bearings have been *performance-proved* on thousands of units operating twenty-four hours a day, year after year. In spindles, for example, Needle Bearings provide high capacity anti-friction performance at high speeds. Their unique ability to retain lubricants means longer bearing life, less attention, uninterrupted output. These advantages multiplied by the thousands of operating units per mill mean considerable savings.

Needle Bearings have become "standard equipment" throughout industry since their introduction nearly twenty years ago. Their small size, high load capacity and long, trouble-free operation have improved many designs and products.

The Needle Bearing may be the answer to your anti-friction problems. Our engineers will be glad to assist with your application.

THE TORRINGTON COMPANY
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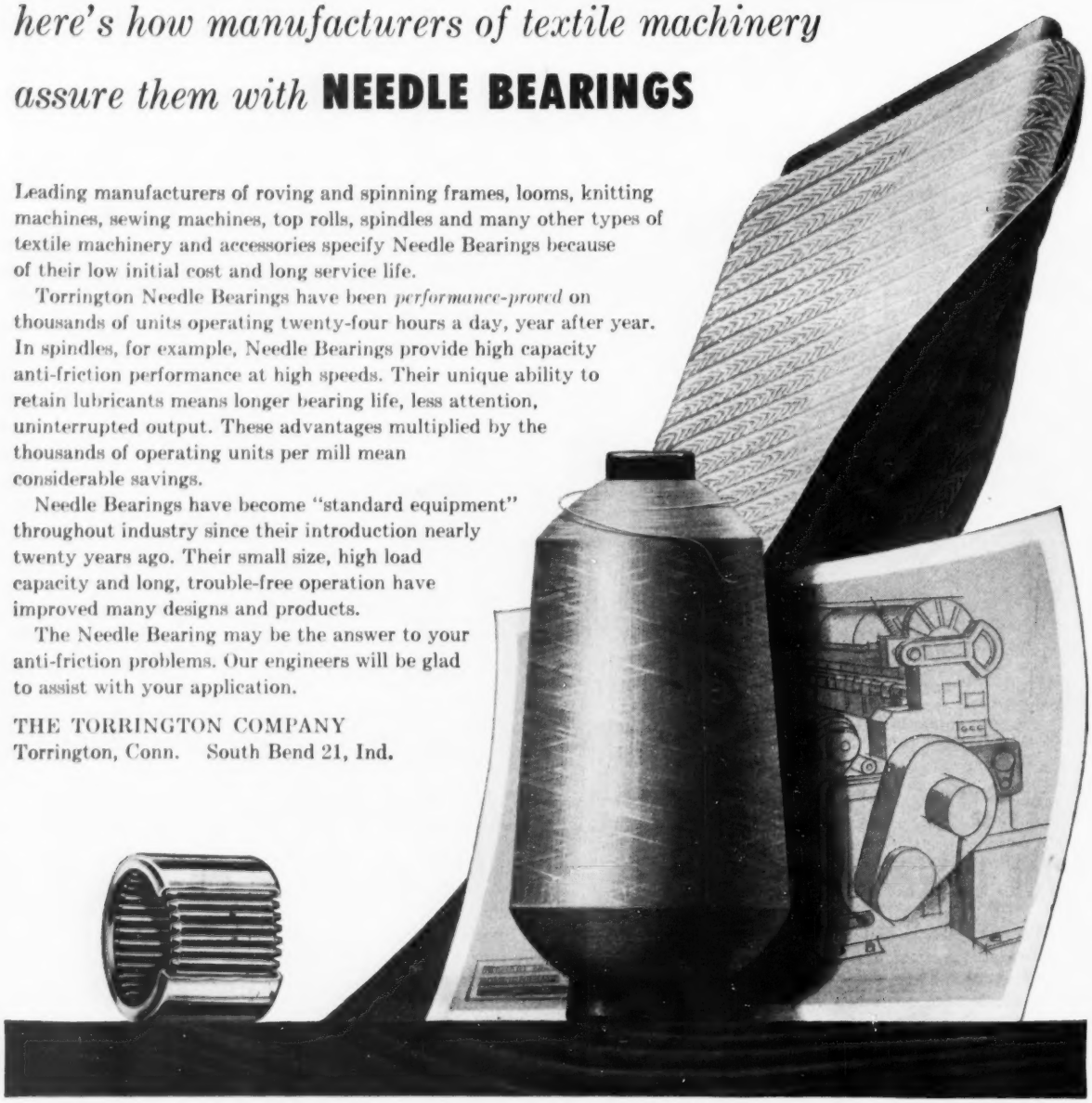

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"We make sure that there is **NO RUST** *on these expensive dies —we use* **GULF NO-RUST**

Application of Gulf No-Rust C (polar type) to three-stage 22-station progressive die, which lances, forms ears, pierces, and forms anchors on automobile parts in one stroke of the press.

"We can't take a chance on rust spoiling the surfaces of expensive dies like these, which cost in the neighborhood of $20,000," says Mr. Folland. "That's why we spray them with Gulf No-Rust C. It not only gives good protection but also displaces any moisture which may already be present on the surface of the dies."

For additional information on Gulf No-Rust C (polar type) or on any of the complete line of quality Gulf rust preventives, send the coupon below.

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1934 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, a copy of your pamphlet, "Gulf Rust Preventives."

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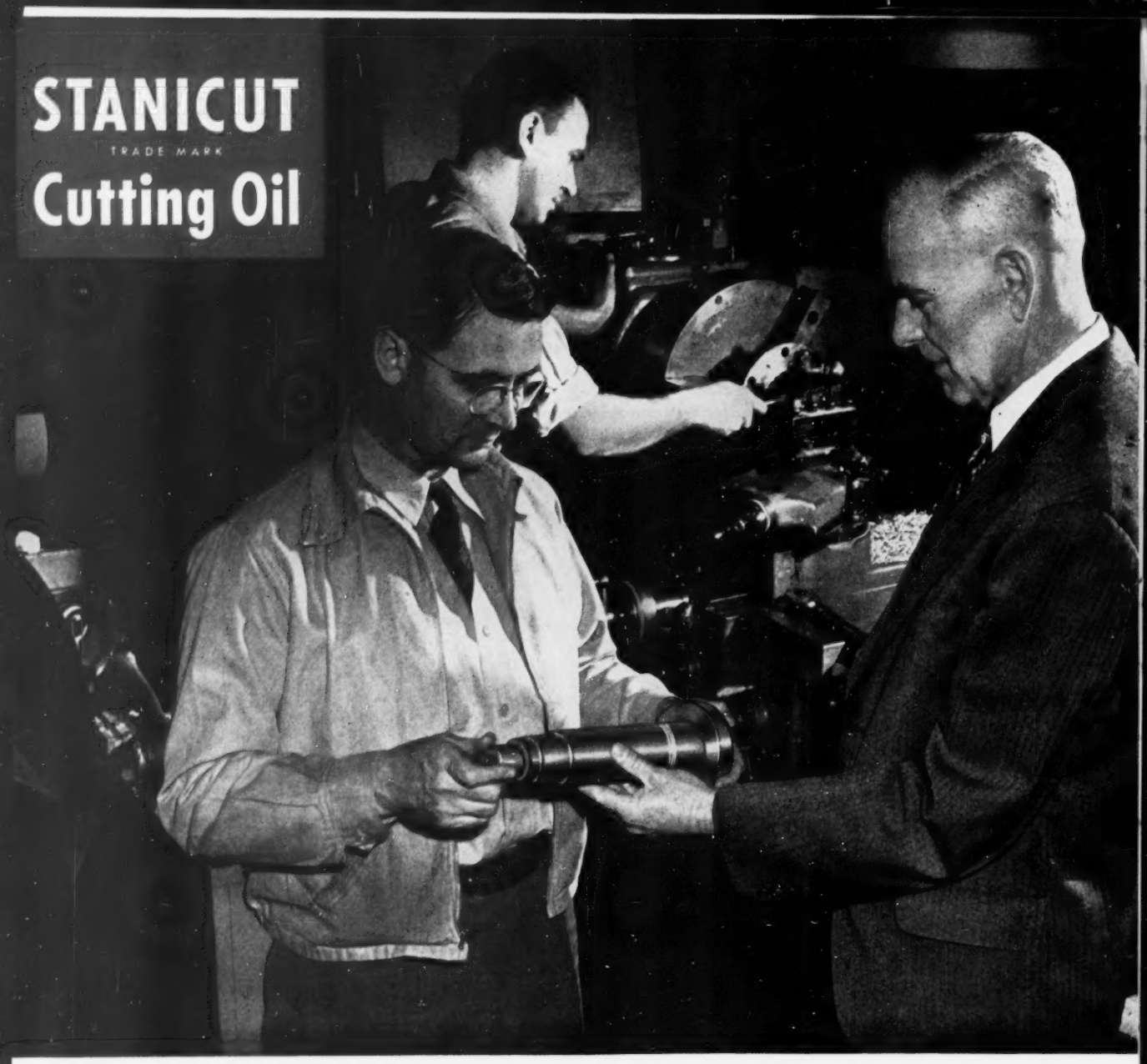


Stops tarnish on copper alloy jobs . . .

● Sciaky Brothers Inc., Chicago manufacturers of spot welding equipment, were having trouble obtaining a suitable finish on certain copper alloy parts. After they were machined, parts frequently had to be processed to remove stain or tarnish. This took time and labor and cut down production.

Upon the advice of a Standard Oil cutting oil specialist, officials of this company put a STANICUT Cutting Oil to work on the troublesome copper alloy machining jobs. It was the end for tarnish troubles. On a wide variety of operations employing many different copper alloys, STANICUT has provided both superior finish and excellent tool life. Of further importance to this company, STANICUT has been used with success on other jobs and, today, is employed for all operations requiring a cutting oil. This has eliminated the cost and trouble of stocking and using several different cutting oils.

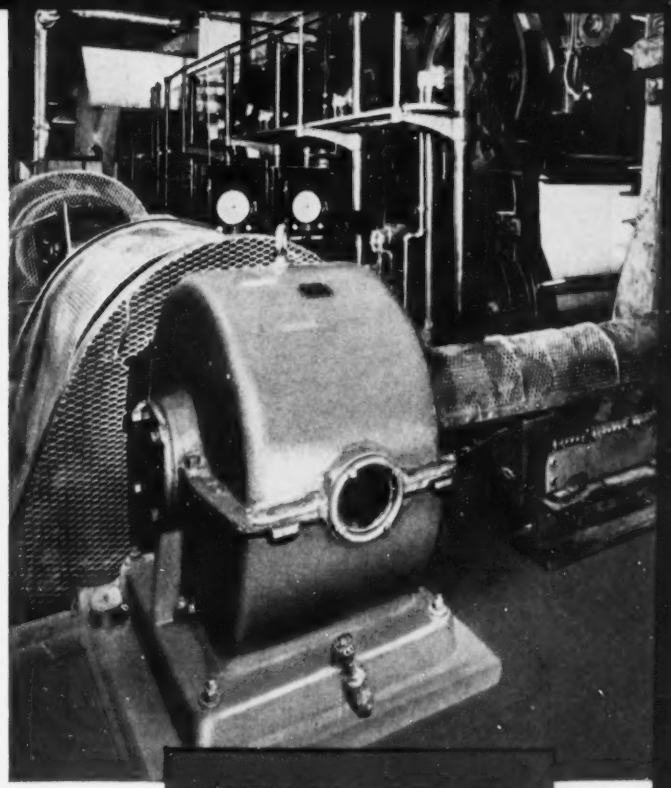
To help you get better cutting oil results, Standard Oil has a metalworking service that is unique in the Midwest. It gives you the metalworking products, the engineering service, and the supply service that fit your special operation and needs. The cutting oil specialist serving in your section of the Midwest will be glad to tell you more about this personalized service. You can reach this man easily by phoning your local Standard Oil office.

What's YOUR problem?

A. L. Seabaugh, who makes his headquarters at Standard's Chicago office, is the cutting oil specialist who recommended STANICUT Cutting Oil to operators of this midwest company and helped them solve a tarnish problem. Moreover, he has followed through on this problem to help his customer make additional cutting oil savings.

A. L. Seabaugh is one of a corps of able lubrication specialists who have headquarters in Standard offices throughout the Midwest. These men have been specially trained in Standard Oil Lubrication Engineering Schools and, in addition, have a wealth of practical experience. The specialist nearest your plant will work closely with you, giving you the help you need when you need it, to produce better cutting oil results.

You'll discover how easily and quickly you can obtain the services of this lubrication specialist by phoning your local Standard Oil office.



NEW **STANOGEAR** REG. U.S. PAT. OFF. **Compounds**

7 ways better for extreme-pressure lubricating jobs!

New and improved STANOGEAR Compounds have been developed to meet the requirements of the tougher extreme-pressure lubricating jobs found throughout industry, today. These outstanding products have proved their ability to provide these important advantages:

1. Higher load carrying capacity.
2. Superior retention of load carrying capacity.
3. Freedom from objectionable deposits.
4. Excellent storage stability.
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7. Versatility.

The Standard lubrication specialist in your area of the Midwest can give you more information about the new STANOGEAR Compounds and help you apply them more effectively. Phone your local Standard Oil office. Or, write, Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

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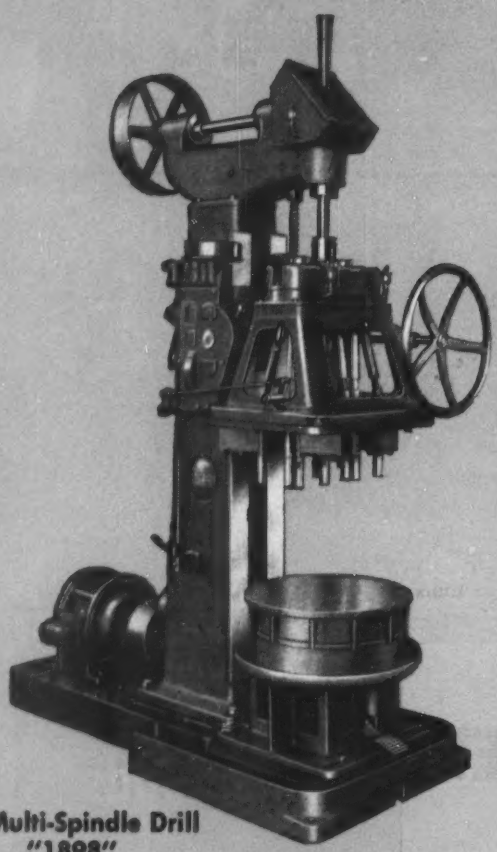
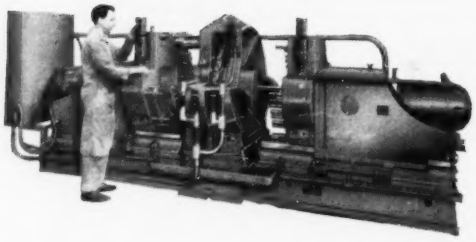


Multi-Spindle Drill
"1898"

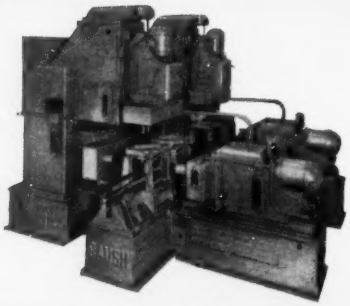
Comparing production and part costs using machine tools like this "Multiple Drill" built 50 years ago, or even those built 15 to 25 years ago, is like comparing a horse-drawn vehicle of the past with the speed and economy of today's travel by plane or car.

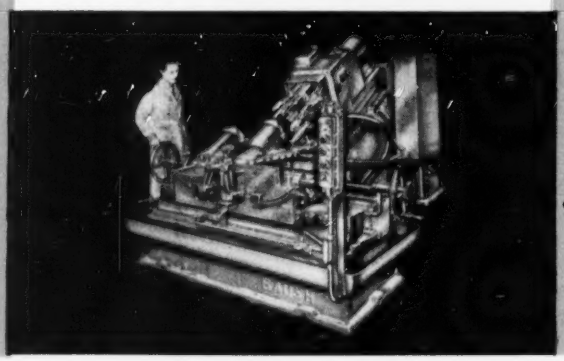
Today's multi-spindle, semi-automatic and multi-operation machine tools — like these other BAUSH units shown — more than pay for themselves in a short time with increased production, lower part costs, and far fewer spoiled parts or rejects resulting from human error.

Why not use the years of experience of Baush Engineers in machine tool design and production??? Send in your production problems and working drawings NOW — our knowledge may mean real profits to you.



Modern Production requires Modern Equipment





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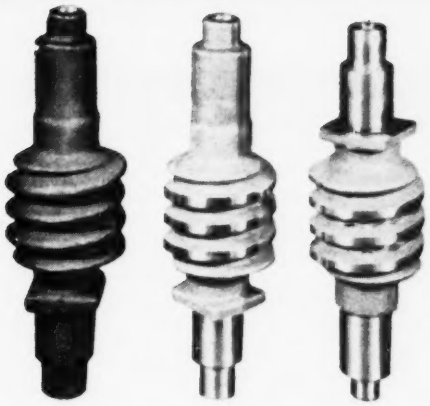


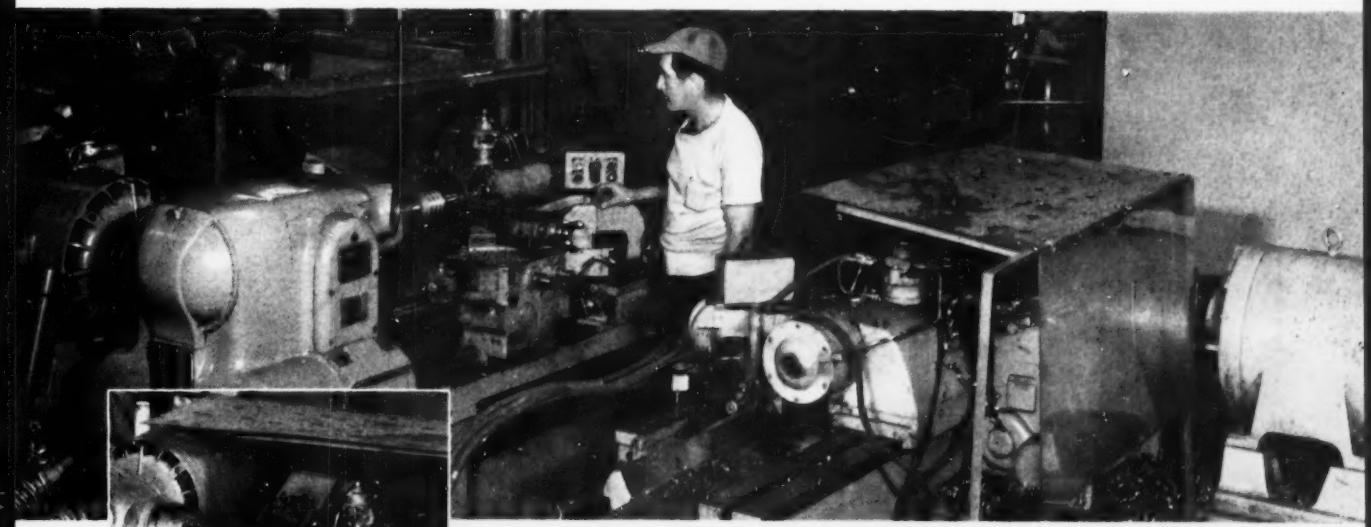
THIS EARLY BIRD GETS THREE TIMES THE WORMS!

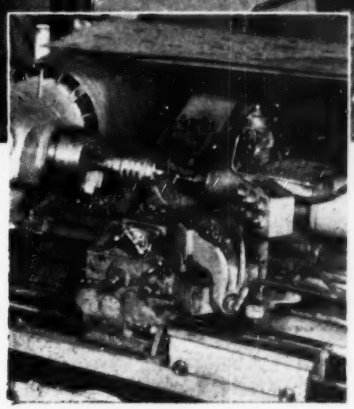
That's the Mona-Matic for you!

"THREE TIMES THE OUTPUT!", says Gar Wood Industries, Inc., of their new Mona-Matic installation. Output has increased, on turning these worm shafts, from 2 pieces formerly put on the floor every 14 minutes, 45 seconds to 2 pieces every 4 minutes, 9 seconds—one man operating two machines in each case. That's more than a 255% production increase for the Mona-Matics!

There's a great performance story here, too. Only a machine built like the Mona-Matic can deliver satisfactory finish and good tool life while maintaining required limits on the intermittent cut over the forged worm threads. The 2-speed motor on Machine #1 easily accommodates the turning of diameters as varied as those of worm threads and shaft end. Excessive stock removal from small end diameter is accomplished by dual template control on Machine #2. With two tools on rear slide of each machine, one faces the end of the shaft while one rough faces a shoulder and forms an undercut.

Here's a machine that can boost output and cut costs on long runs and short ones. Why not find out—right now—what it can do for you? Write for Booklet 1805 containing full information, data, job reports. It's new! . . . *The Monarch Machine Tool Company, Sidney, Ohio.*





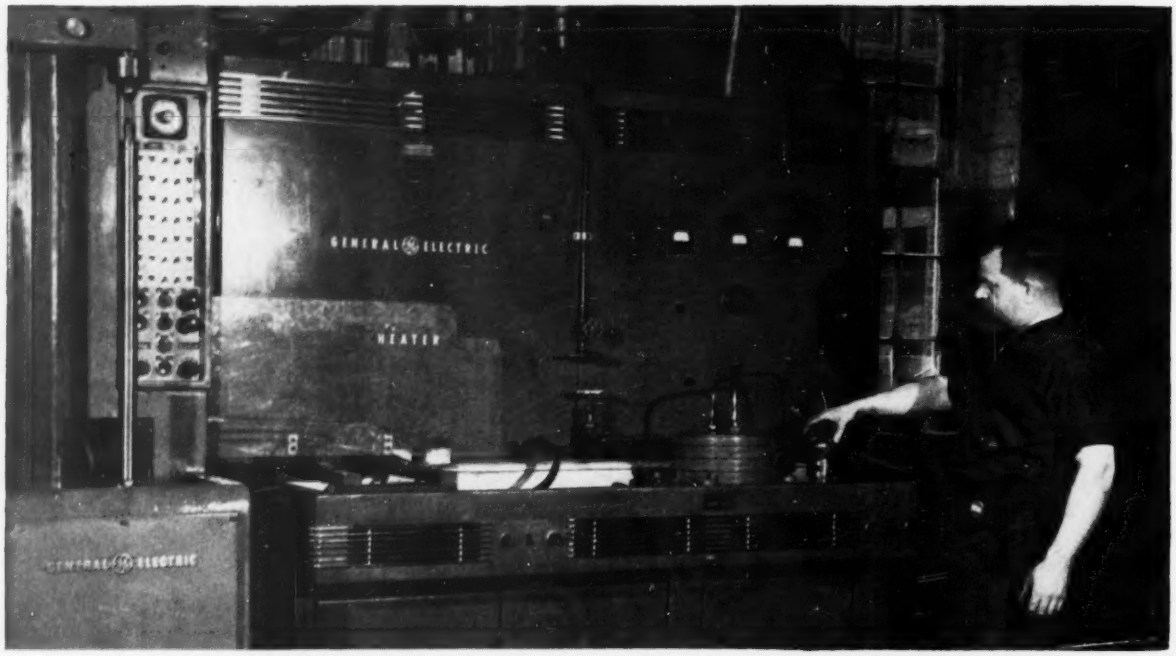
Part—Worm Shaft. **Material**—SAE 8640 forging. **Operation**—turn complete for grind using carbide tools. Limits ± .001". **Comment**—with one operator for two machines in each case, output has soared from 2 pieces every 14 minutes, 45 seconds to 2 pieces every 4 minutes, 9 seconds—a 72% reduction in machining!

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH



INDUCTION HARDENING TEXTILE-MACHINE PARTS AT WHITIN MACHINE CO.

Hardening Output Increased Ten Times With G-E Induction Heaters

"Since changing to General Electric induction heaters for hardening twister rolls we've increased our hardening output ten times and improved product quality!" reports Arno Wagner, heating engineer, Whitin Machine Co., Whitinville, Mass.

When using cyanide furnaces for hardening, it took Whitin 3½ hours to harden only 11 rolls. Now, by applying selective G-E induction heat, Whitin hardens over 35 rolls per hour! Because parts require no expensive preparation for heating—necessary with furnace hardening—Whitin has reduced costs significantly. Hardness tests show induction-hardened rolls to be stronger and of more uniform hardness.

Improved working conditions are another benefit now enjoyed by Whitin, because compact G-E heaters eliminate the discomfort of radiant heat and provide cleaner, more comfortable working conditions.

Included in Whitin's heating operation are one 50-kw and three 20-kw G-E heaters. Used primarily for hardening over 500 parts for textile machines, these versatile heaters are also applied for annealing, soft soldering, and silver soldering. In each case, substantial savings in time and money have resulted.

This high-quality selective heating at lower cost is available to you. To learn how you can profitably apply G-E induction heat to your operations, contact your G-E Apparatus Sales representative. And write now for bulletins on G-E induction heaters to General Electric Co., Section 720-118, Schenectady 5, N. Y.

PROGRESSIVE HARDENING twister roll in this G-E fixture is done automatically at the rate of two inches per second.

SURFACE HARDENING machine part is a fast process. Only 20 seconds are required to harden, quench, and remove part.

You can put your confidence in—

GENERAL ELECTRIC

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Part of Butterfield's fine reputation for taps and dies
stems from rigid control over quality production.
The value shows up in performance.

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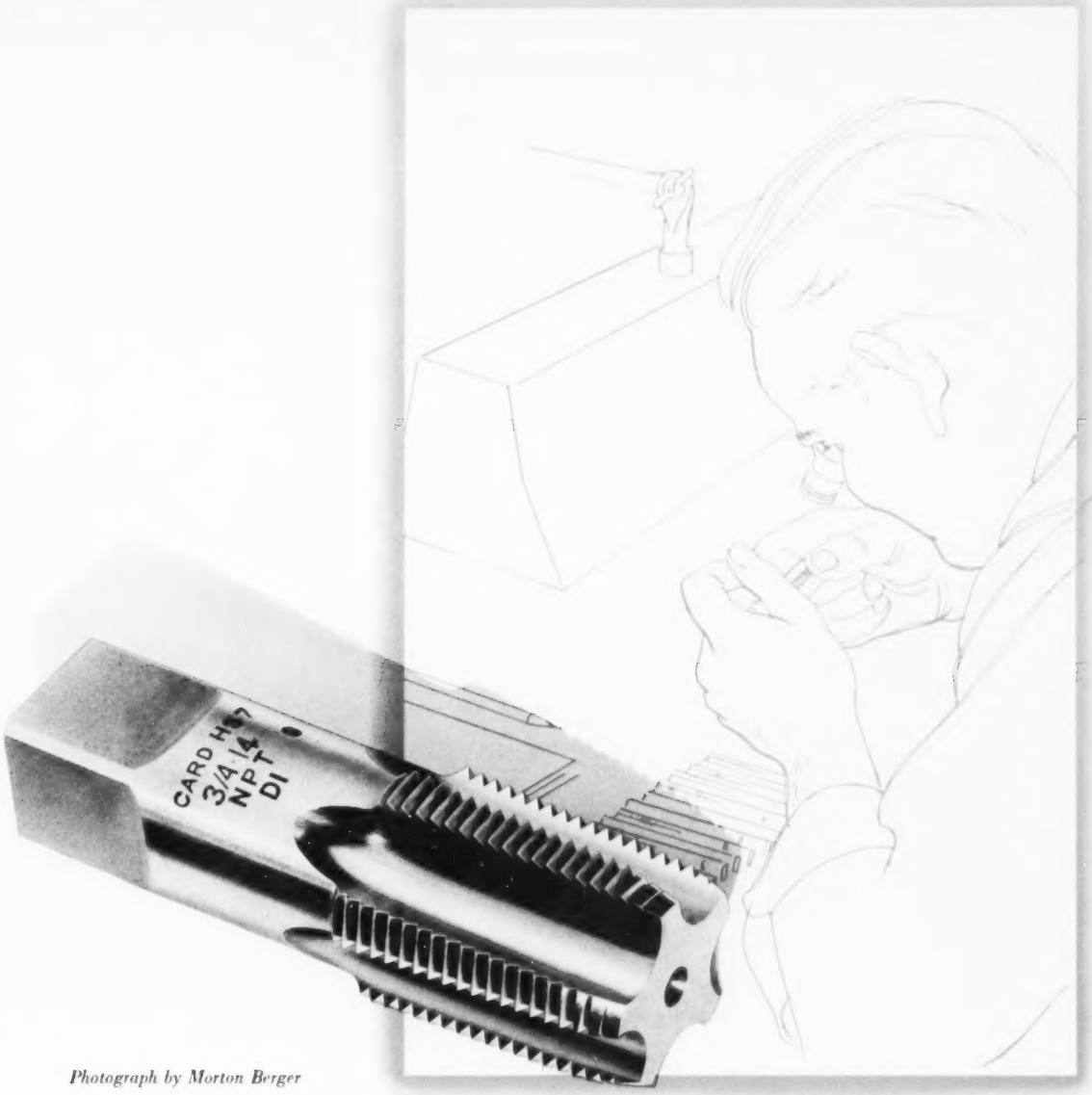

Photograph by Morton Berger

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The quality is greater than the price. **When you specify Card Taps you get far more than fine steel expertly engineered. You get the benefit of an accumulation of experience in tap making that dates back 79 years.**

Completely stocked offices at Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco and Seattle.

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S. W. CARD MANUFACTURING CO., MANSFIELD, MASS. • DIVISION OF UNION TWIST DRILL CO. **TAPS • DIES • SCREW PLATES**

Designing FOR MULTIPLE PRODUCTS IN SINGLE TOOLING WITH MADISON-KIPP

ZINC AND ALUMINUM DIE CASTINGS

The three castings illustrated are made in the same die. Provision for the changeable die parts must be included in the original die design. Expert die making is also involved, but the end results of this type of pre-planning represent substantial savings in many instances.

Madison-Kipp is skilled and seasoned in die casting mechanics and invites your inquiries for cooperative effort.

kipp

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203 WAUBESA STREET, MADISON 10, WISCONSIN, U.S.A.

- Skilled in Die Casting Mechanics
- Experienced in Lubrication Engineering
- Originators of Really High Speed Air Tools

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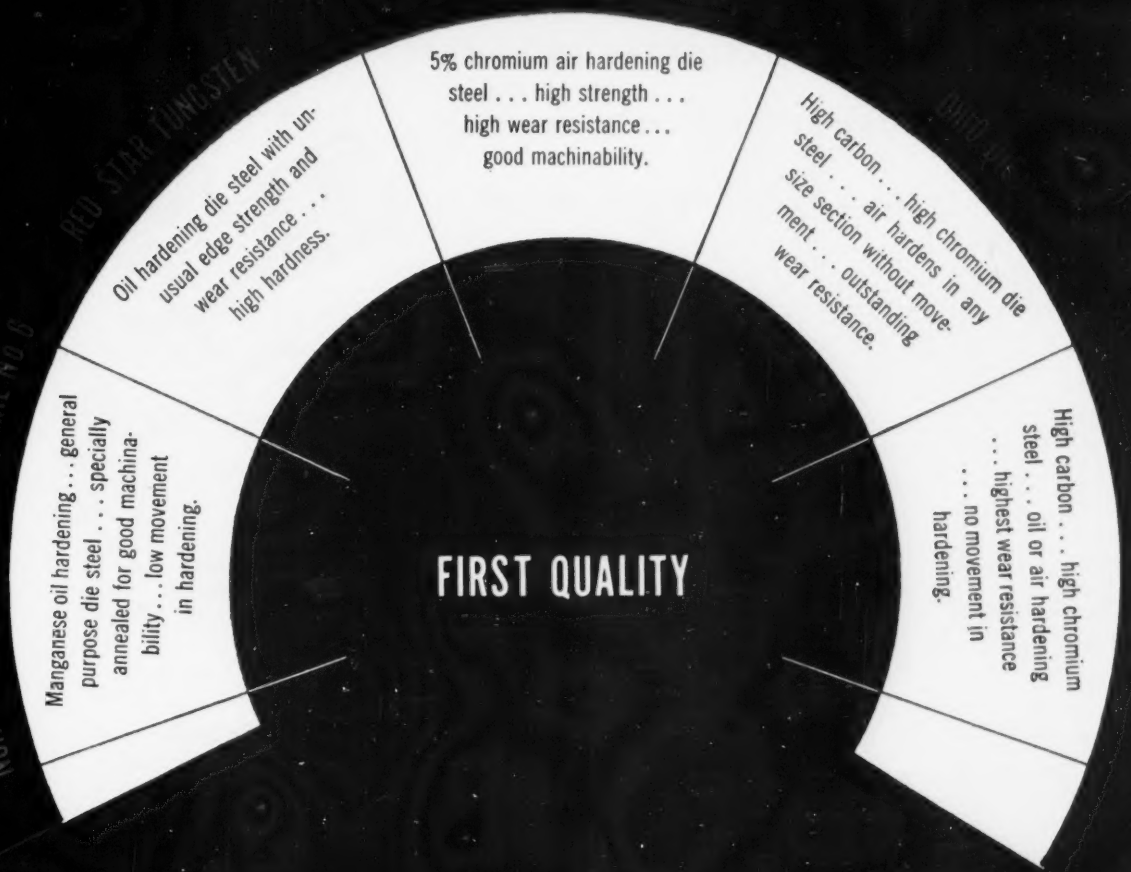
AIR HARD
RED STAR TUNGSTEN
NON-SHRINKABLE COLONIAL No. 6
5% chromium air hardening die steel . . . high strength . . . high wear resistance . . . good machinability.
Oil hardening die steel with unusual edge strength and wear resistance . . . high hardness.
High carbon . . . high chromium die steel . . . air hardens in any size section without movement . . . outstanding wear resistance.
Manganese oil hardening . . . general purpose die steel . . . specially annealed for good machinability . . . low movement in hardening.
High carbon . . . high chromium steel . . . oil or air hardening . . . highest wear resistance . . . no movement in hardening.
FIRST QUALITY

cold work

These Die Steels for Cold Work are designed to cover every performance requirement, and for adaptability to available heat treating facilities. Each grade is carefully annealed and fully inspected by magnaflux, reflectoscope and deep etching to insure First Quality selection. Our Representative in your area will gladly assist you with your needs.

Write for your free copy of our detailed metallurgical brochure on "Die Steels for Cold Work."

Vanadium-Alloys
STEEL COMPANY
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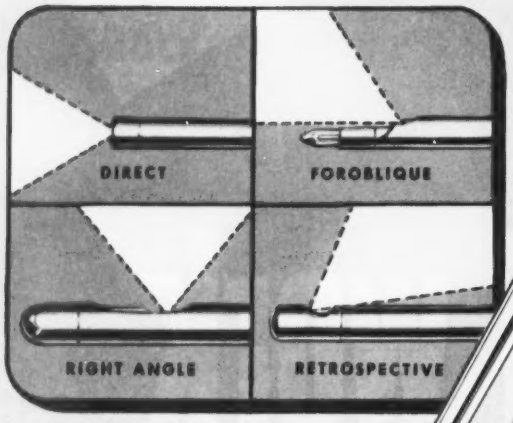
COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL CO.

INSPECTION OF CONFINED AREAS FACILITATED

NECESSITY OF DISMANTLING AVOIDED

TIME SAVED—MONEY SAVED

A.C.M.I. BORESCOPES



A.C.M.I. Borescopes are available in 4 angles of vision (as above)— in diameters of .120" to 4.00"— in lengths of 4" to 720". Special models for special problems.

The A.C.M.I. Borescopes permit close-up visual examination of interior areas and surfaces not otherwise visible. They save time and money, and prevent costly dismantling, by providing a practical solution to a wide variety of inspection problems.

In maintenance and inspection work, on small internal bores, machine parts or castings, to large boiler tubes, chemical plants, process equipment, or other industrial installations, an A.C.M.I. Borescope may be the answer to *your* problem.

Each Borescope is a compact, self-illuminated industrial telescope of highest quality, employing a precision optical system, that produces a flat visual field. Lens systems are fully corrected for color, spherical aberrations, and coma, with all lens surfaces coated to increase light transmission.

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American Cystoscope Makers, Inc.

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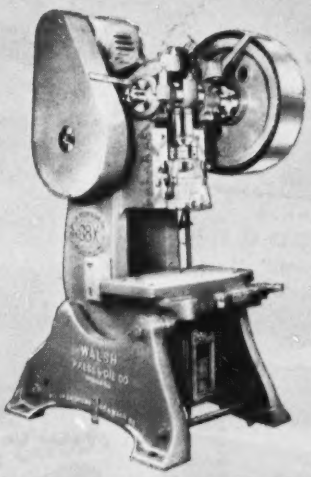

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Some made in 1907 with rugged dependability are *still* operating at a profit.
Wide selection of sizes from 6-65 tons . . . STOCK to 4 weeks delivery.
24 HOUR REPAIR *SERVICE*
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. . . give you 5 or more gages for the price of one—*reversible* and extra length for new gaging surfaces at no additional cost.
THREAD REVERSIBLES
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IMMEDIATE DELIVERY FROM STOCK

with WESSONMETAL
THE CARBIDE Specially ENGINEERED FOR METAL CUTTING!

Fine Pitch Cone Type Face Mill inserted blade Solid or tipped blades

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All sizes and styles

Huskicut Tool Holder 70% more regrinds per tip

Multicut Bond Type Tool Holders
101 Standard Sizes—changeable insert replaceable bond.

Solid Carbide Standard Blanks

Solid Carbide Blades

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"V-Nose" Blanks

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Tracer Lathe Tool Holder
55° insert up to 35° Clearance
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Special Bond type Tool Holders

Wesson's new PLANER TOOL Replaceable Blade.

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THE WESSON MAN IN YOUR AREA
An Experienced Tool Engineer Trained in Carbide.

See "THIS CARBIDE AGE"
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WESSONMETAL CORPORATION
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Saves Time... Cuts Costs

Rotary Planer • • • do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.

Big Sawing • • • production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.

The **ESPEN-LUCAS** *Machine Works*

Front Street and Girard Ave., Phila. 23, Pa.

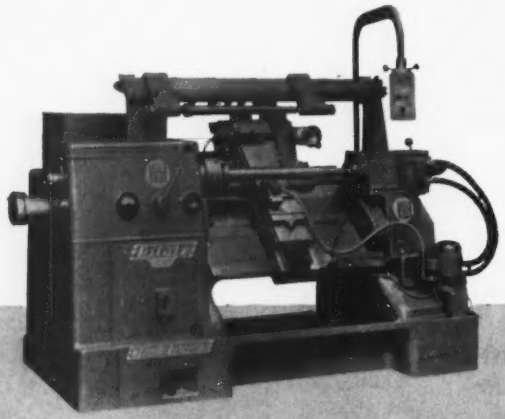
BUILDERS OF LARGE COLD SAWING MACHINES • ROTARY PLANERS • COLUMN FACERS • HEAVY TYPES OF SPECIAL MACHINERY

HIGH SPEED HYDRAULIC Copying Lathes *for every purpose!*

THE TURNING METHOD OF THE FUTURE TODAY!

The greatest advance in turning methods since the development of carbide tools! Whether your production is on a large scale or you need short, economical runs, there is an H.E.B. Copying Lathe to fit the special needs of your operation.

Why use a dozen tools when the H.E.B. *with just a few* does the job faster, better and at less cost! Incorporating the patented H.E.B. tracer device these versatile machines give you maximum output at high speed with remarkable accuracy and finish.

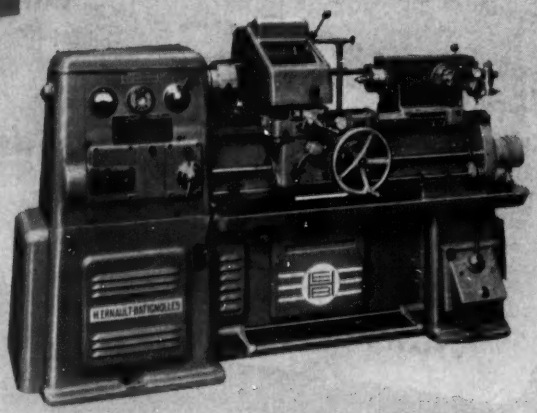


H.E.B. PILOTE COMPLETELY AUTOMATIC HYDRAULIC COPYING LATHE

The first *completely automatic* hydraulic copying lathe. The operator has only to load the machine and *press a button* to start the cycle. When the part is finished the tool returns to its starting position and the spindle stops automatically! Savings in setup time and tooling costs are enormous. Motors to 60 H.P.

COMPLETELY AUTOMATIC

SEMI-AUTOMATIC



H.E.B. HIGH SPEED HYDRAULIC COPYING LATHE

This absolutely rigid, chatter-free machine with built-in tracer device eliminates costly down time, takes no more than 10 to 20 minutes for setting up and the finished parts are copy turned up to 300% faster than on multi-tool lathes.

The OP Model, with its 20 H.P. motor, takes heavy cuts with carbide tools at spindle speeds 50 to 3600 RPM. GT Models with rotating pattern are designed to copy an infinite variety of non-circular work.

These machines are designed and built in France by H. Ernault Batignelles, machine tool manufacturers for almost a hundred years. If you want more information about tomorrow's turning methods, then write, wire or telephone *now* for a demonstration or catalog. See our insert in Sweet's Machine Tool Catalog.

"THE WAY TO TURN"

H·E·B

H. E. B. MACHINE TOOLS, INC.

475 FIFTH AVENUE • NEW YORK 17, N. Y.

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COPYING LATHES • ENGINE LATHES WITH COPYING ATTACHMENTS • CARBIDE TOOL GRINDERS • RADIAL DRILLS

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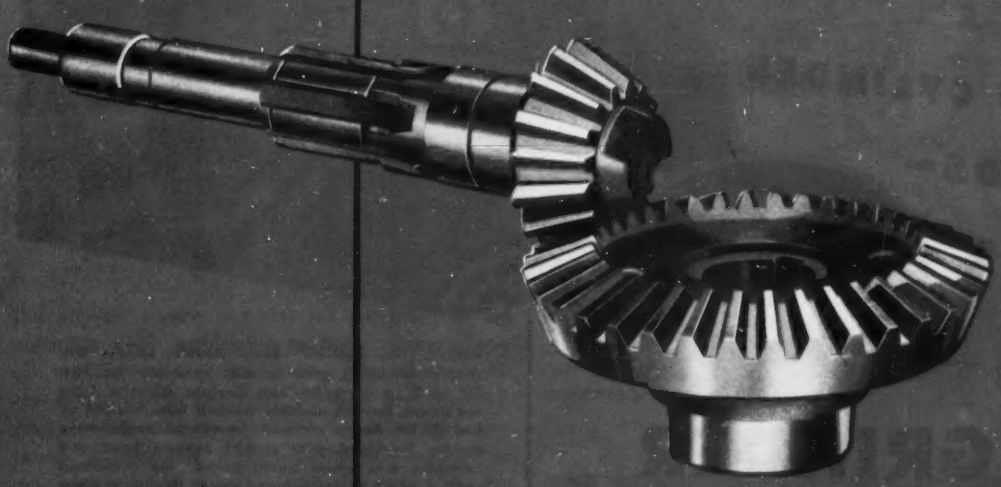
GEARS

for every purpose



Skilled Illinois Gear craftsmen are at your command to produce gears for every purpose—from gears rotating the massive, grinding weight of 100 ton shovels to gears controlling the tension of huge cylinders that speed delicate tissues through paper mills at thousands of feet per minute.

With the finest precision gear making equipment available *anywhere* Illinois Gear can fill your orders on time and meet your most demanding specifications.

Send your next order to Illinois Gear!

ILLINOIS GEARS Reg. U.S. Pat. Off.

Gears for Every Purpose ... one gear or 10,000 or more

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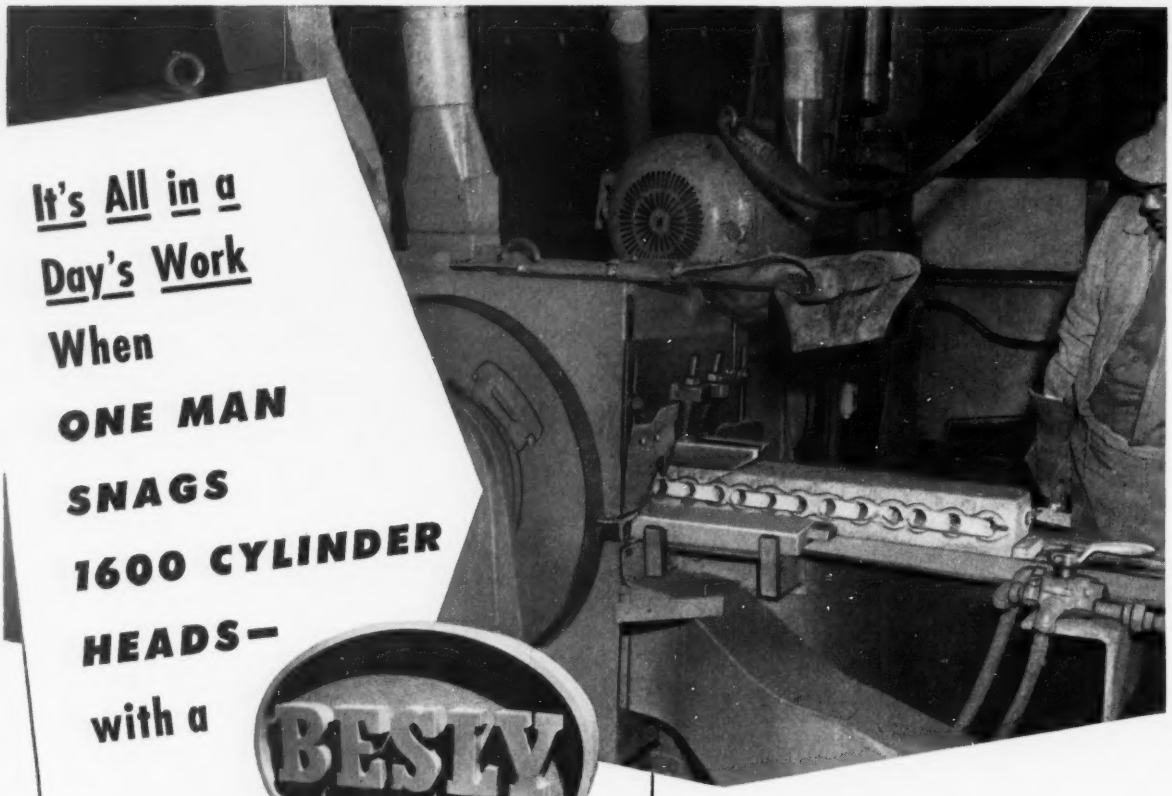


It's All in a Day's Work When ONE MAN SNAGS 1600 CYLINDER HEADS— with a BESLY GRINDER

A Man and a Grinder Replace a Crew of Hand Chippers to Avoid Holdups in Feeding Automobile Engine Production Line!

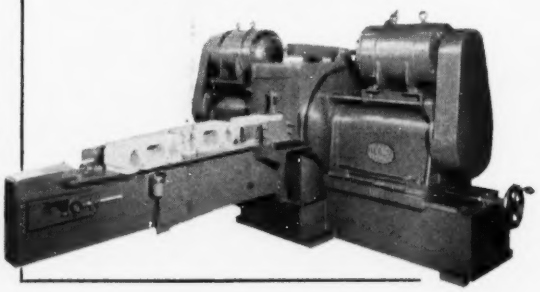
A Besly No. 630-30" Double Spindle Dry Grinder, attended by one man, now snags the fins from 1600 automotive cylinder head castings a day. Cast iron heads five to six inches thick, are conveyed hot from the foundry to the grinder operator who breaks off larger pieces of excess metal with a few hammer blows. The castings are then moved to a power-driven feeding fixture on the Besly Grinder, and fins 3/16 to 5/16-inch thick are ground off automatically *with a single pass,* producing clean, smooth, ready-to-machine castings.

It is production policy to meet the required cylinder head quota daily. With the Besly Grinder set-up, this manufacturer makes considerable savings in labor since a hand chipper crew is no longer required . . . and gets a better, more satisfactory job as well.

With changes in fixturing, the Besly No. 630 Grinder can be adapted to a wide variety of grinding operations, one of which may well speed and simplify your manufacturing process. Ask your Besly representative about this and other cost-cutting Besly Grinders for all needs!

ABOVE: No. 630-30" Besly Double Spindle Dry Grinder set up to grind cylinder head castings. Two 30" x 2" x 6" Besly-Titan Steelbac Abrasive Discs are driven through multiple vee-belt transmissions by two 25 HP, totally enclosed, fan-cooled, ball-bearing motors. Equipped with special exhaust hood and swinging arm wheel truing device. The continuous chain feeding fixture is motor driven through a worm and worm gear reducer. Special guide plates and spring-loaded hold down shoes accommodate the various castings.

BELOW: Besly No. 630 Grinder fixtured for smooth-surfacing tops and bottoms of concrete blocks.



BESLY-WELLES CORPORATION

Established as
CHARLES H. BESLY & CO. in 1875
112 Dearborn Ave., Beloit, Wis.

BESLY GRINDERS and ACCESSORIES • BESLY TAPS, DRILLS, REAMERS, END MILLS • BESLY-TITAN ABRASIVE WHEELS

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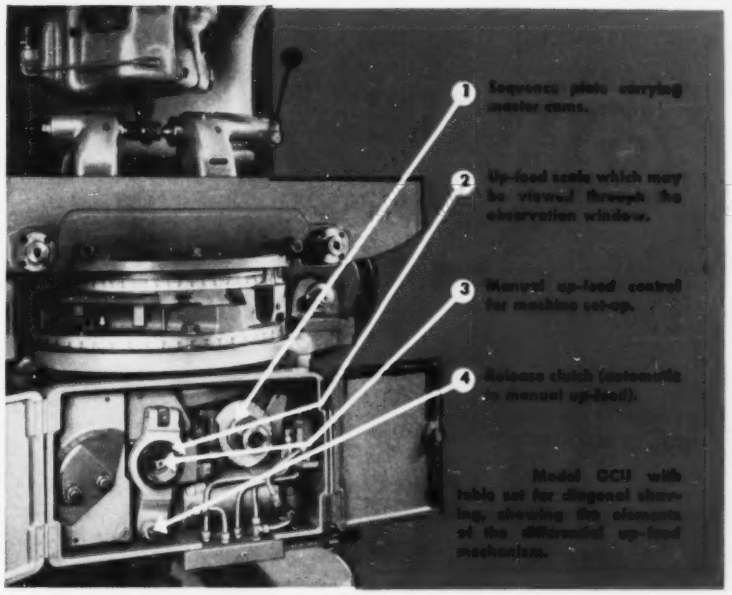
GEAR SHAVING NOW

Much Faster and More Flexible



When Automatic Differential Up-feed and Conventional Crowning were added to the Red Ring Model GCU, shaving speed, flexibility and economy were all significantly increased.

AUTOMATIC DIFFERENTIAL UP-FEED

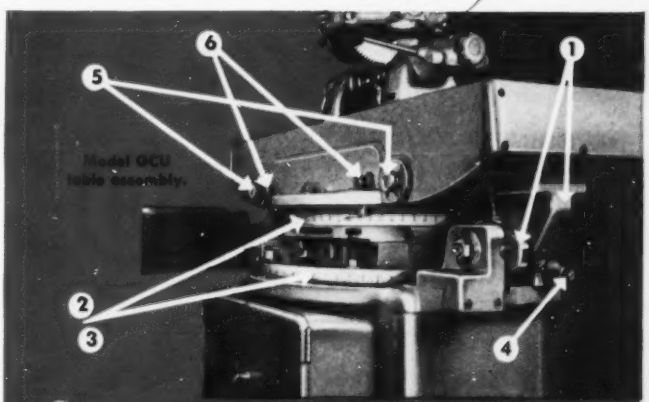
This efficient device provides for the first time an automatic cycle applicable to both diagonal and conventional shaving. This cycle is controlled by an eleven-position master cam. Included are backlash take-up, infeed cutting strokes, idling strokes and return to unloading backlash. The entire cycle or any portion of it may be used depending on job requirements.

The cam itself does not actuate knee movement. It is strictly a stepped gaging device. Consequently every knee movement is positive, extremely precise and very fast. No danger of operator's errors. Perfect accessibility for fast loading and unloading.

One of the two control cams carried by the feed unit sequence plate.

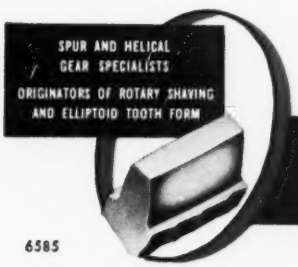
CROWNING

Gears being shaved conventionally can be crowned by rocking the table about a central pivot during the automatic cycle. The cam controlling the rocking movement is located on table centerline to avoid any tendency to twist. This device also provides for taper shaving.



1. Crowning cam and bracket.
2. Scales for diagonal shaving set-up.
3. [illegible]
4. One of 2 tapered shoe bolts used to realign table and ways for conventional shaving.
5. Lock pins when removed, permit table to rock for conventional crowning.
6. Bolts operated from the front of the machine actuate tapered wedges to lift table to the ways.

Write for Bulletin S53-7 for full details.



NATIONAL BROACH & MACHINE CO.

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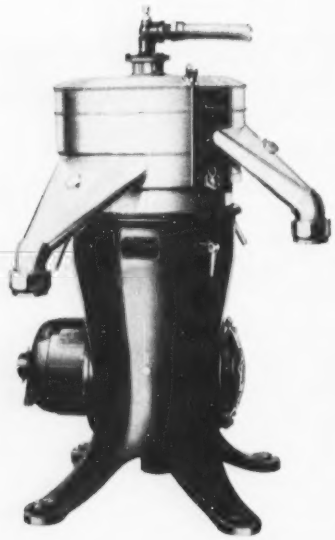
6585

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

CENTRIFUGE THESE OILS

For Safer, More Economical Tests:

- SHOCK ABSORBER
- ENGINE BLOCK
- ENGINE LUBRICATION
- TRANSMISSION



De Laval Oil Purifiers keep test oils continuously clean . . . free of all contamination. By means of centrifugal force they promptly and continuously throw out of the oil all abrasive or solid matter that the test oil picks up in circulating through the engine, transmission or other automotive unit. These centrifugal machines insure that when oil is pumped back to the test floor, it is clean beyond the shadow of a doubt and safe to reuse.

There are many uses for De Laval Oil Purifiers in all types of metal working plants. Sometimes the basic problem is to keep oil clean, as in the cases cited above; sometimes the problem is the dehydration of an oil. In both cases a De Laval machine offers the certain, sure method of achieving the desired result.

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL PURIFIERS AND CLARIFIERS FOR FACTORY OILS

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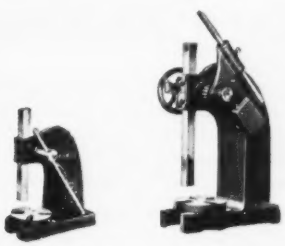
ARBOR PRESSES

IN 32 MODELS



Plain lever type

Simple ratchet type

Compound ratchet floor type

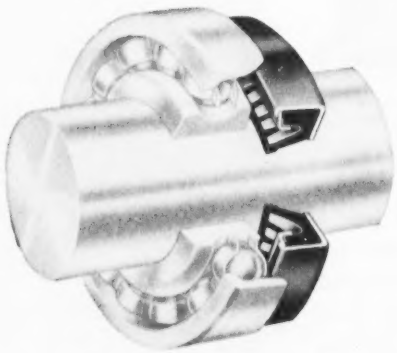
Famco offers the world's most complete line of arbor presses, assuring the most economical size for every job. 32 rugged bench and floor models deliver from 1/2 to 15 tons pressure. Plain lever, simple ratchet, combination compound and simple ratchet types have exclusive front and side gib adjustment for perfect ram alignment. Reinforced semi-steel frames, alloy steel rack and pinion. See your Famco Dealer or write for Catalog.

FAMCO MACHINE COMPANY

3134 SHERIDAN ROAD
KENOSHA, WISCONSIN

AIR PRESSES • ARBOR PRESSES • BAND SAWS • DRILL PRESSES
FOOT PRESSES • POWER PRESSES • SQUARING SHEARS

Dependable Bearing Protection for All Service Conditions



Model 53 KLOZURE, with standard sealing element, applied to a shaft to protect the ball bearing.

The true value of any oil seal must be measured by the ability of the sealing element to protect the bearing by keeping the lubricant *in*, dirt and moisture *out*.

For your bearing protection Garlock KLOZURES offer you these important sealing-element advantages:

1. **Synthetic rubber sealing elements** for oil, grease, water, mild acids and alkalies at temperatures up to 300° F.
2. **Silicone rubber sealing elements** for extremes of high and low temperatures.
3. **Teflon sealing elements** for strong acids.
4. **Choice of sealing element designs** with finger spring or garter spring for light, medium or heavy duty service at all speeds.
5. **All sealing elements** accurate and uniform in size, non-porous, tough, durable, non-abrasive and free-running.

Garlock KLOZURE Oil Seals are made in a complete range of sizes and in many models. For complete information call your Garlock representative or write for KLOZURE Catalog No. 10.

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THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
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GARLOCK

**PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS**

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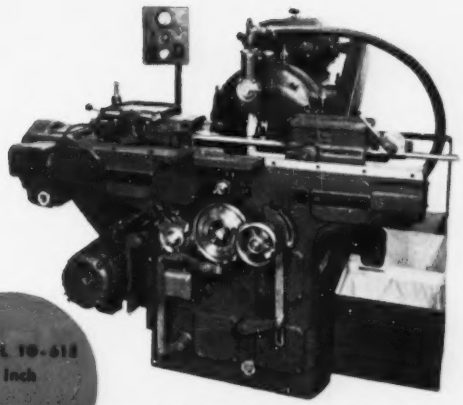
Quality threading

AT MINIMUM COST



MODEL TG-618
6 x 18 Inch

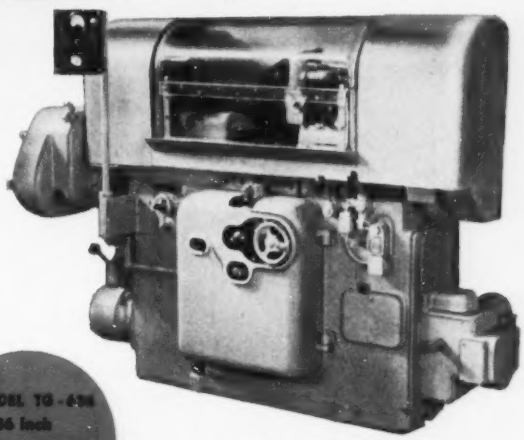
The 6 x 18 Automatic Thread Grinder is used for high production thread grinding with either single or multi-ribbed wheels on relatively small parts.

JONES & LAMSON
AUTOMATIC THREAD GRINDERS:

- Produce threads of better quality and more uniform finish
- Reduce handling cost
- Eliminate costly rethreading after heat treatment
- Eliminate expensive retooling when specifications change
- Reduce cost of gage maintenance

Built-in accuracy and automatic features, make any of these machines a paying investment for toolroom or production line.

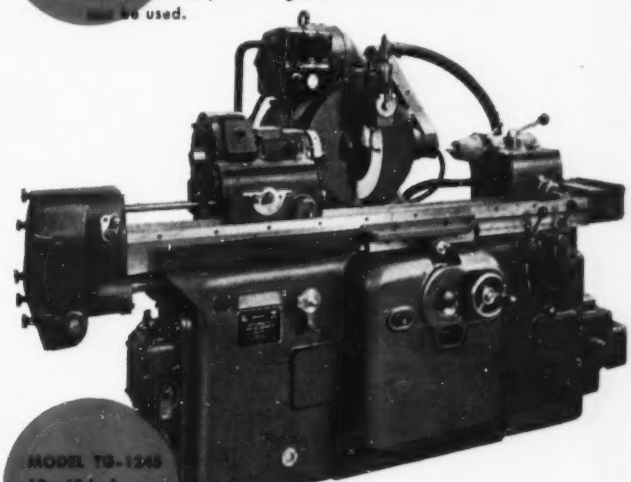
- Automatic wheel truing
- Automatic infeed on successive cuts
- Automatic sizing
- Rheostat wheel speed control
- Diamond or crush dressing of wheels
- Multi-ribbed threading
- Right and left hand threading



MODEL TG-636
6 x 36 Inch

The 6 x 36 machine is extremely versatile and is used on long or short run jobs on a great variety of precision threaded parts. Single or multi-ribbed wheels may be used.

When measuring the value of a thread grinder remember the extra benefits of J & L top-flight construction. Write Dept. 710 for illustrated catalog.



MODEL TG-1245
12 x 45 Inch

The 12 x 45 machine is used for grinding threads on a wide range of work from small to large heavy parts. Single or multi-ribbed wheels can be used.

JONES & LAMSON

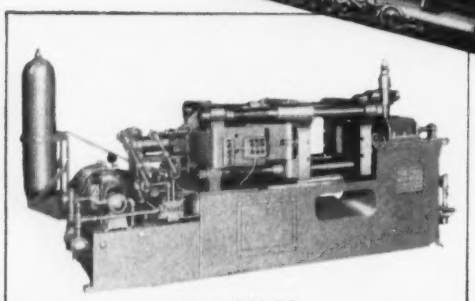
Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A. THREAD GRINDER DIVISION

KUX

FIRST NAME IN DIE CASTING MACHINES

HELPS MAKE HUBLEY
FIRST NAME IN ACTION TOYS



MODEL **BH-30**
Hydraulically operated die casting machine for production of zinc castings weighing up to 10 pounds.

THE TEXAN

Boys hate to be called, "sissy". To prove they're not, they go to great lengths to be rough and tough. That means their toys, too, have to be rough and tough. Hubley Manufacturing Company, by using KUX die casting machines in the manufacture of its "Texan" Repeater Pistol, gets that extra ruggedness necessary in producing toys that last.

WHAT ABOUT YOUR PRODUCT? Does it stand up to the treatment it has to take? KUX die casting machines can tremendously improve its quality and saleability. Call KUX now! Let us show you how!

KUX MACHINE COMPANY • **6725 N. Ridge, Chicago 26, Illinois**

KUX

FIRST NAME IN DIE CASTING MACHINES
SELECTED BY FIRST NAMES IN INDUSTRY

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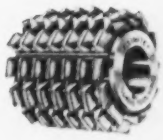
ILLINITE®

STANDARD CUTTING TOOLS

produced by cutting tool experts to toolmakers' standards of precision and quality

Here are precision metal cutting tools produced by master toolmakers, available through a nationwide system of stocked distributors. End mills, milling cutters, saws, keyslot cutters, shaper cutters, hobs and tool bits—all reflect the design features, precision workmanship and top quality materials that have made Illinois Tool Works "Headquarters" for metal cutting tools! Now, ILLINITE *Standard* Cutting Tools *from stock* assure convenient service, faster cutting, longer tool life.



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Every tool illustrated—complete dimensional and purchasing data —organized for your convenience!

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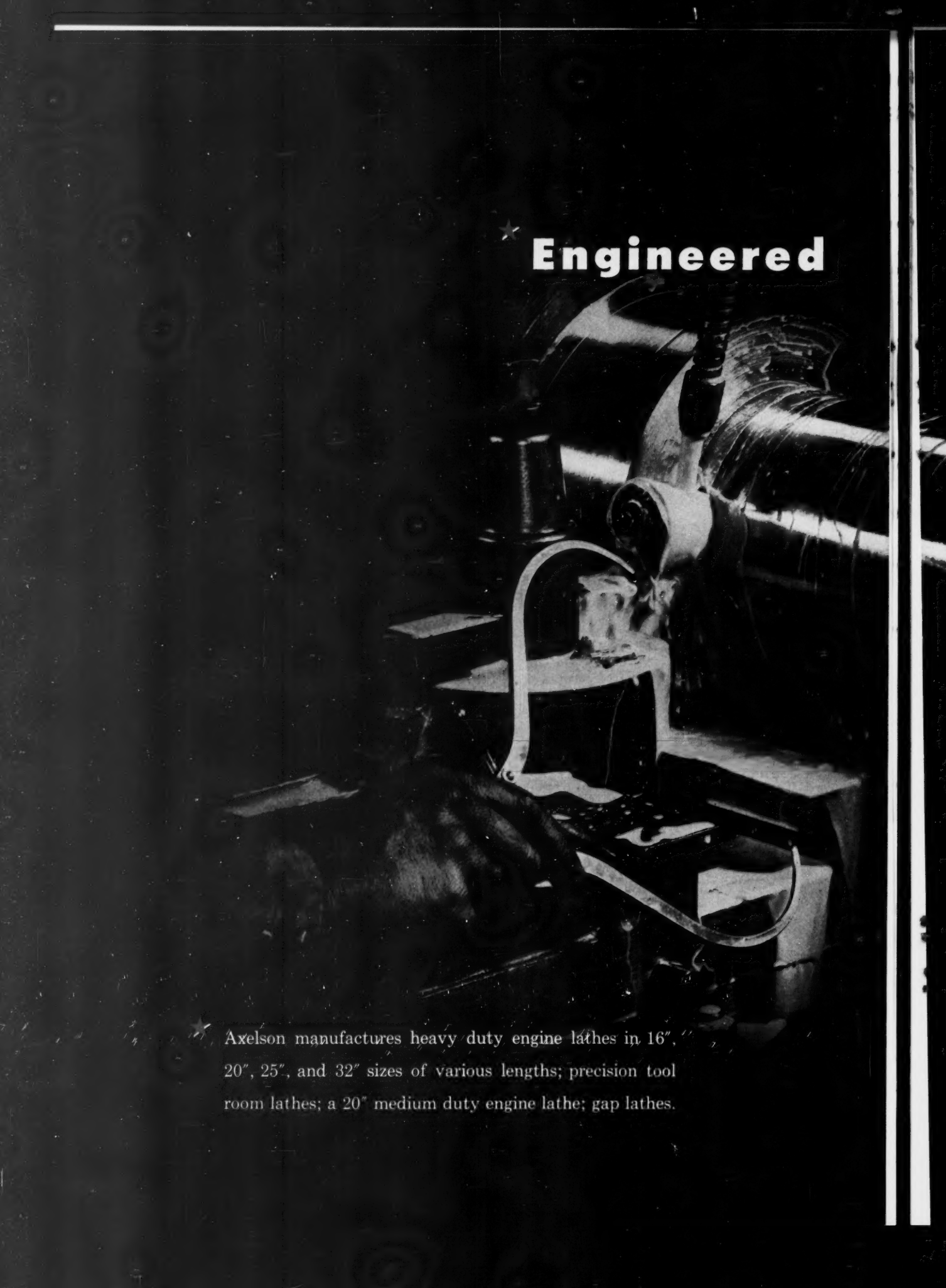
Chicago 39, Illinois

STOCKED BY LEADING INDUSTRIAL DISTRIBUTORS

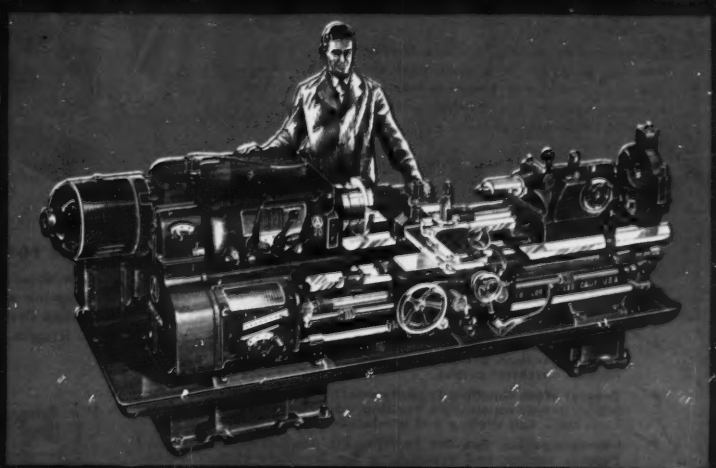


Engineered

Axelson manufactures heavy duty engine lathes in 16″, 20″, 25″, and 32″ sizes of various lengths; precision tool room lathes; a 20″ medium duty engine lathe; gap lathes.

for the tough jobs, too!

From the heaviest roughing cut down to the finest precision cut Axelson lathes are designed and manufactured to give precise, accurate service. Critical dimensions "stay put" because each Axelson lathe part is produced under strict metallurgical control. Recording pyrometers keep continuous time and temperature records of hardening, tempering and normalizing operations on gears, spindles, shafts, lead screws, etc. Quality built, Axelson lathes are capable of delivering dependable, accurate work under the most difficult operating conditions.



AXELSON Lathes

PSC

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

CHOSEN FIRST . . . . TO LAST!

TOOL ROOM LATHES • GAP BED LATHES • HEAVY DUTY ENGINE LATHES

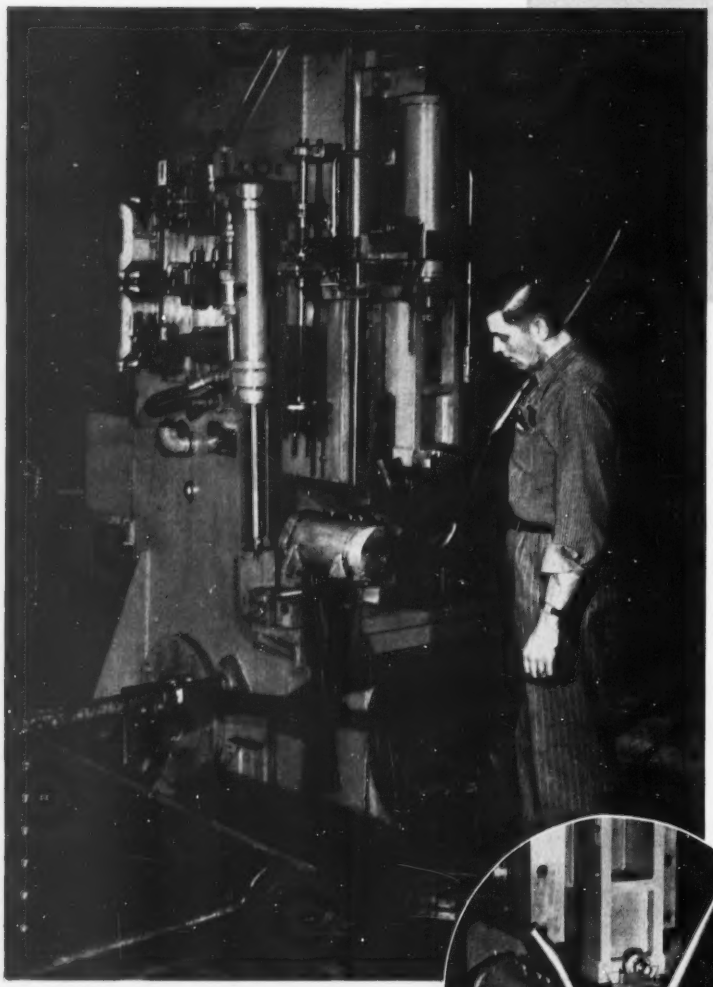
AXELSON MANUFACTURING COMPANY • Division of Pressed Steel Car Company, Inc. • Los Angeles 58 • New York 7 • St. Louis 16

Authorized Distributors in All Principal Industrial Centers

New PINES 20-TON BENDING PRESS

PRODUCES AUTOMOTIVE EXHAUST PIPES

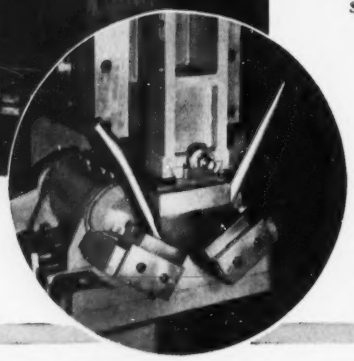
50% FASTER



▲ Production view of new Hydraulic Bending Press now producing, in a single setup and with one operator, 4 to 8 multiple bends on automotive exhaust and tailpipes at speeds from 600 to 800 bends per hour.

The new Pines 20-Ton Hydraulic Pipe and Tube Bending Press is now establishing new records of production efficiency on many different bending operations. For example, on automotive exhaust and tailpipes, multiple bends with 4″ and 6″ radii are now produced in 1-1/4″ to 2″ O.D. 16 ga.-18 ga. tubing at speeds ranging from 600 to over 800 bends per hour.

On an over-all basis, current results show these jobs are produced 50% faster than with ordinary bending press equipment. At the same time, because of the design of the Pines, savings up to 30% in setup time are effected. Further, because more jobs can be handled in a single setup, there's a substantial reduction in tooling expense. If you have work adaptable to a bending press, it will pay you to see Pines today.



◀ Closeup view of Pines Bending Press forming 4th bend in a 1⅜″ (16 ga.) CRS automotive exhaust pipe. Note how wing dies are controlled by side-mounted cushions through heavy crank arms. Interchangeable pick-off turret of angle-of-bend selector saves set-up time on repeat jobs.

CHECK THESE COST-CUTTING PRODUCTION FEATURES

- **Twin Equalizing Side-Mounted Cushions** — provide greater working clearance, maintain constant torque, reduce flattening and distortion.
- **Faster Cycling** — angle-of-bend selector indexes and resets to starting position automatically without indexing through idle stations, increases output.
- **Greater Work Handling Capacity** — extra clearance reduces number of setups on multiple bending, permits broader use of uniform radii, cuts tooling and production costs.
- **Interchangeable Pick-Off Turret** — for angle-of-bend control. Permits storing and remounting for repetitive jobs, reduces setup time.
- **Adjustable Ram Speed Control** — assures efficient operation, simplifies setups. Ram can be lowered slowly or stopped at any point.

WRITE FOR NEW 4-PAGE BULLETIN

Write today for free bulletin completely illustrating and describing the new Pines Bending Press and its cost-cutting production features.

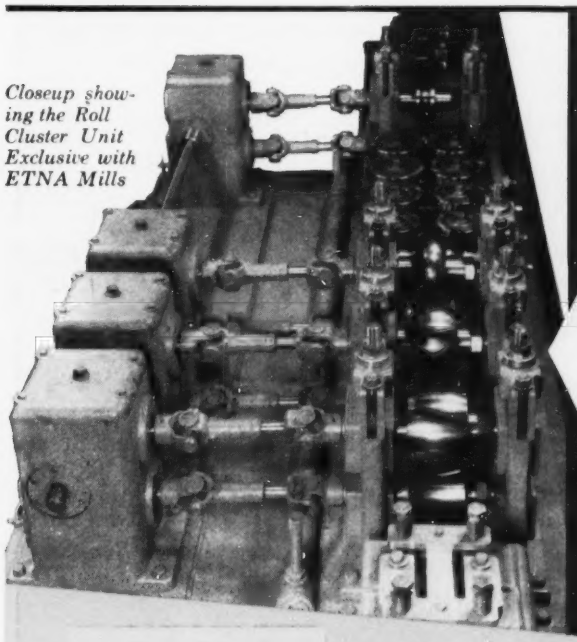
PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery | 686 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

For more information on products advertised, use Inquiry Card, page 261

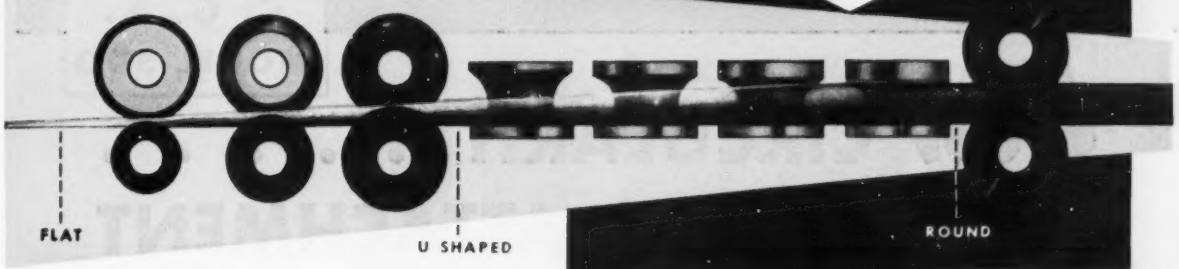
LEADING THE INDUSTRY IN DESIGN...



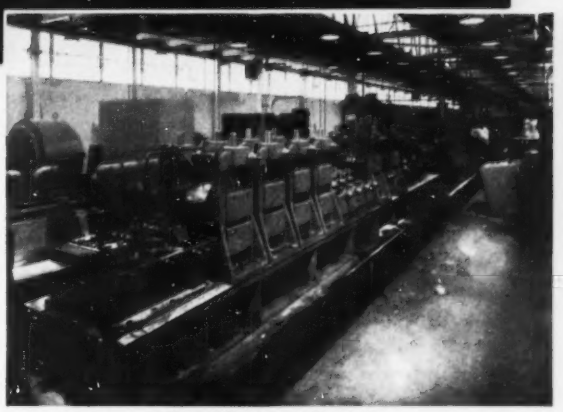
Closeup showing the Roll Cluster Unit Exclusive with ETNA Mills

NO MARKING . . . NO SCRATCHING
NO UPSET EDGES . . .

THE Etna METHOD
FOR SMOOTH, WELL FORMED STEEL TUBING



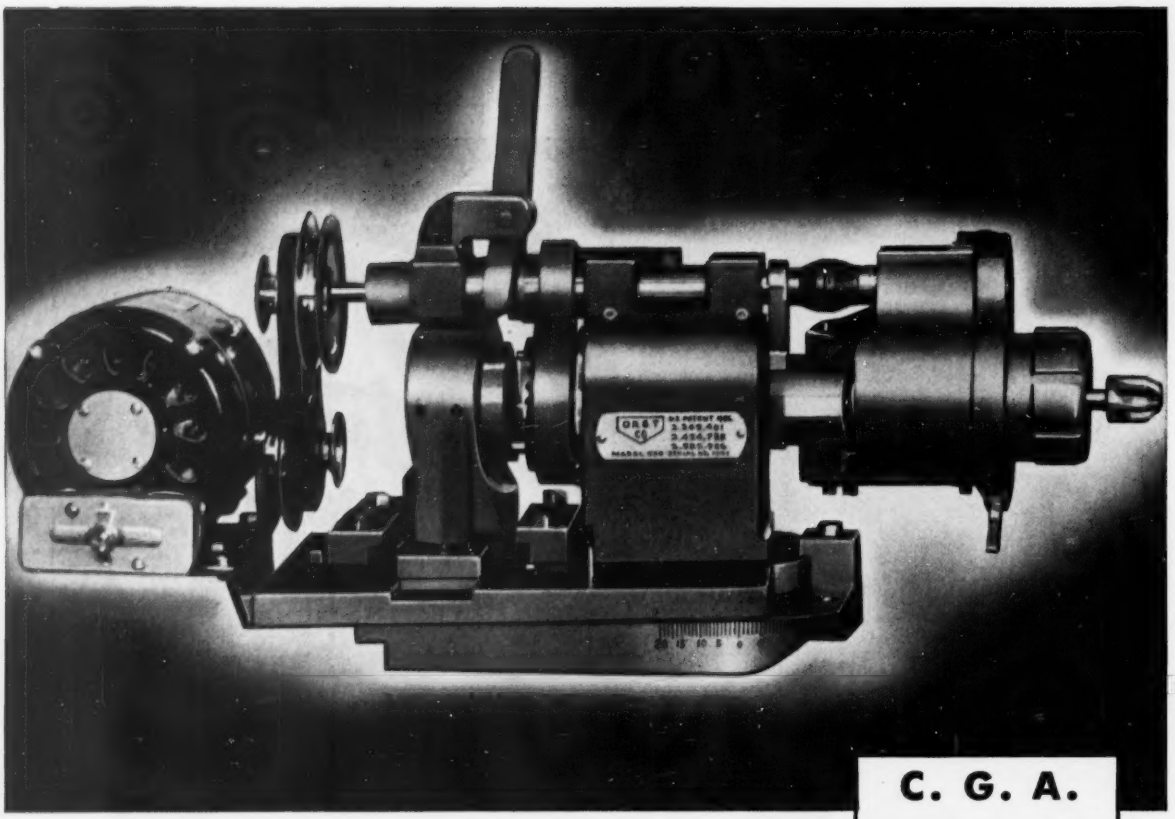
Exclusive with Etna is the cluster unit. This unit progressively rolls the tube into shape without excessive stretching of the edges, thereby eliminating the "buckling" experienced with ordinary tube mills. Etna machines are not forming mills, they are designed for one purpose only . . . to make clear, well formed carbon and stainless steel tubing with no marking, no scratching, no upset edges. Write for complete details.



The ETNA 4KU Mill

Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO



C. G. A.
MODEL 500

New CIRCULARITY. . . . . GRINDING ATTACHMENT

Detroit Reamer & Tool Company engineers, after months of intensive research and extensive development, have produced in the model 500 Circularity Grinding Attachment a new device that has many outstanding improvements. This new model is faster, easier to handle, has positive control, greater adaptability, rugged construction, and is engineered and precision built to provide the finest in precision work. Therefore, it will be of invaluable assistance to anyone whose tooling standards must meet modern production requirements.

Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, radial relief, form and radial relief together, tapered cylindrical and straight cylindrical. Cutting tool to be produced or reworked is held in collet or between dead centers and revolves on its own axial center. Where full length of spiral cutting tools is to be ground for both form and radial relief, the Circularity Grinding Attachment travel is similar to an O.D. grinder, which insures fine finish, back taper and accurate size.

DETROIT REAMER & TOOL CO.

2830 E. SEVEN MILE ROAD • DETROIT 34, MICH.

D R & T COMPANY

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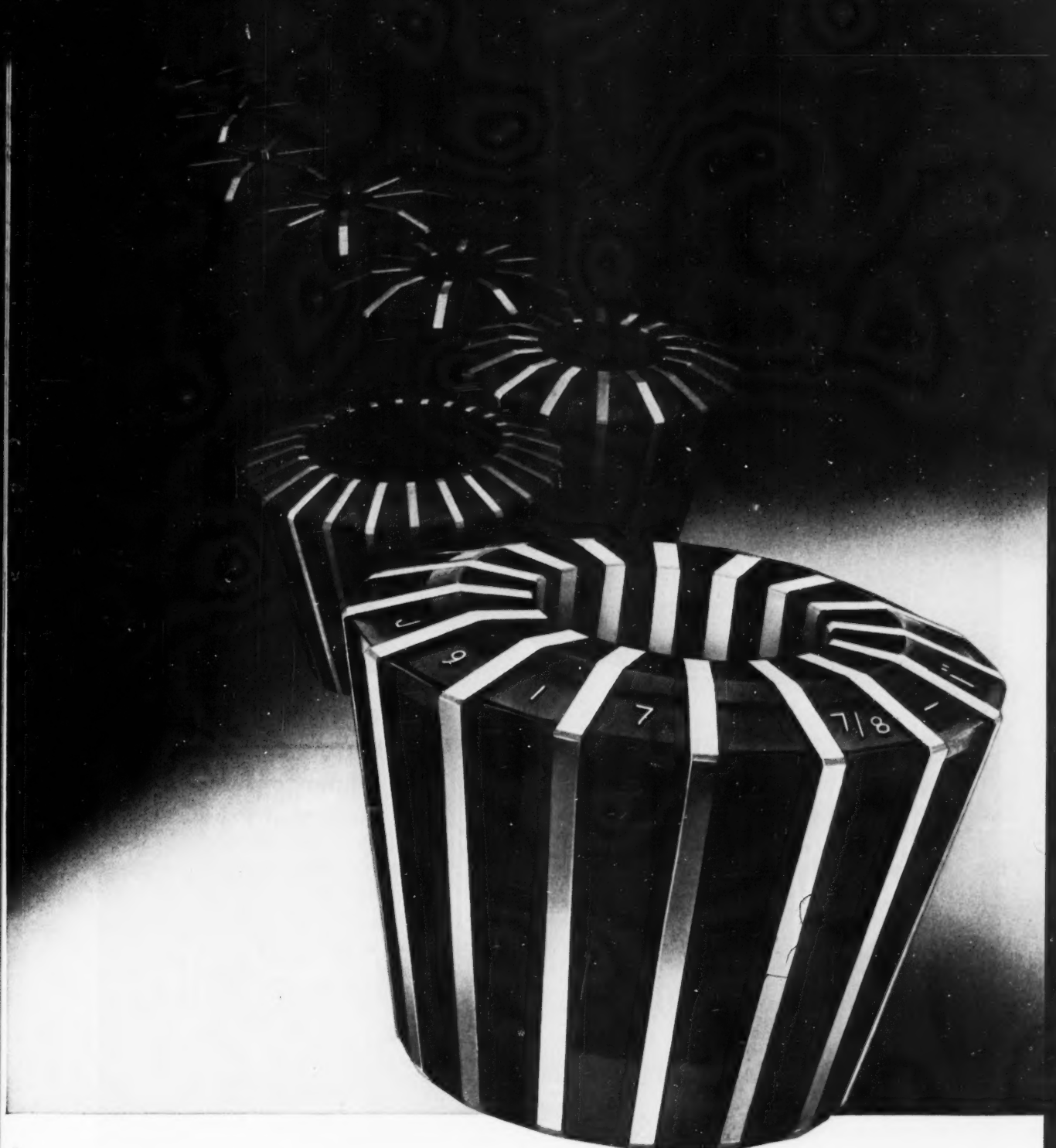


UNPARALLELED GRIP *from parallel jaws*

Latest And Greatest In Collet Design! Tool engineers and machine tool builders praise the Jacobs Rubber-Flex Collet as one of the outstanding developments in modern tool history. This new principle of collet construction brings you not only great improvements in gripping power, accuracy, and service life, but — *for the first time* — a collet with a full ⅛ inch capacity range.

The Jacobs Manufacturing Company, West Hartford 10, Conn.

IF IT'S A JACOBS IT HOLDS

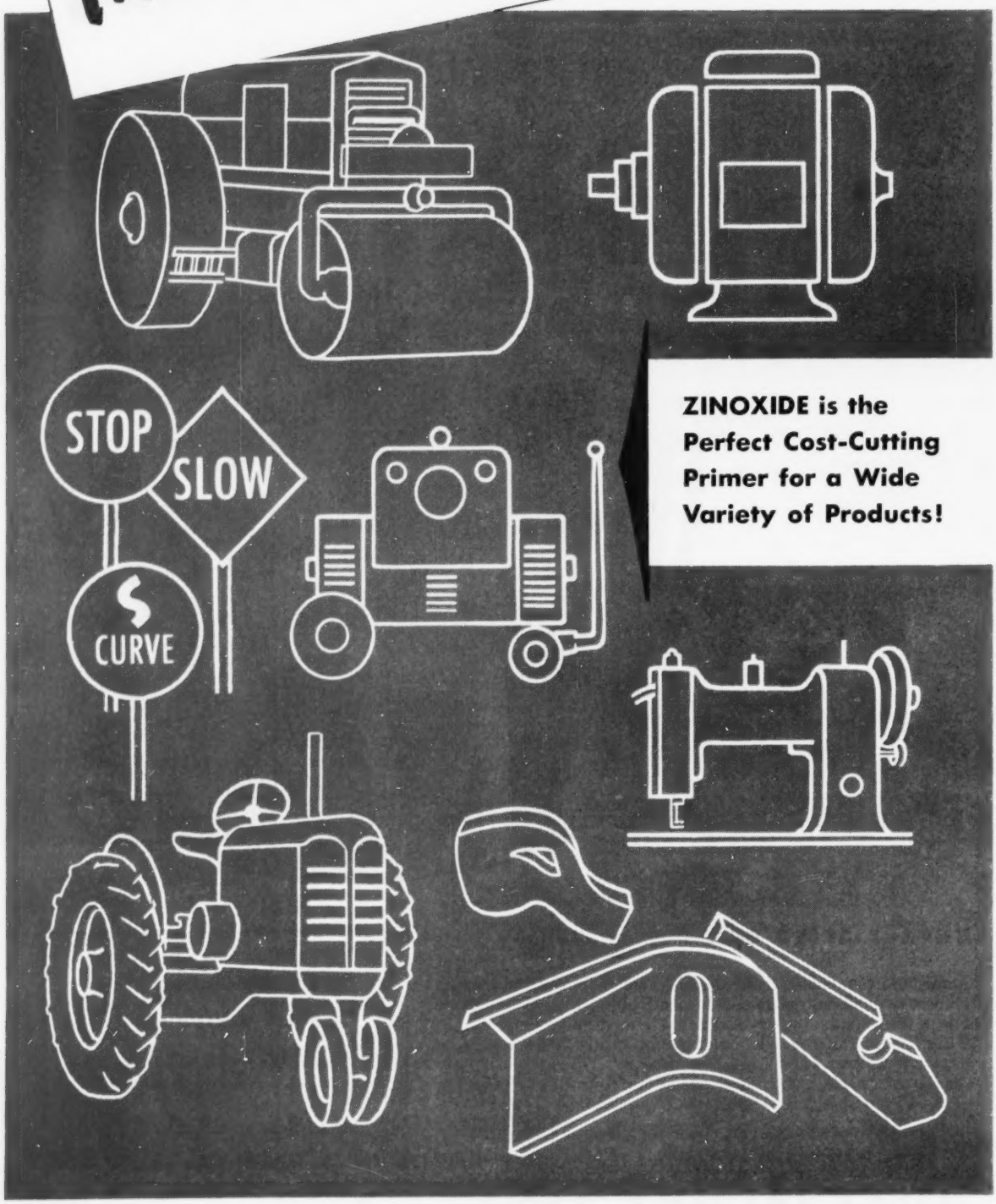
Jacobs and your local distributor

are ready to deliver the chucks you need and the service you deserve.

. . . first in chucks

. . . first in service

Introducing... The One Chromate



ZINOXIDE is the Perfect Cost-Cutting Primer for a Wide Variety of Products!

And Only Known Zinc & Oxide Primer made in 3 colors!

Lowe Brothers ZINOXIDE Primer makes Finishing News as the Outstanding METAL PRIMER DEVELOPMENT of Today!

now available in...

Lowe Brothers' case history files are already packed with factual evidence that ZINOXIDE Primer is one of the greatest developments in the history of industrial finishes. *But now,* by making it available in *3 colors,* Lowe Brothers "Finishing Specialists" have given users of ZINOXIDE a tremendous extra advantage. *Now,* you can select a prime coat *in the color closest to that of your finish coat* and enjoy all of the additional savings in handling time and material costs made possible by just *one* final finishing coat!

Check These Outstanding ZINOXIDE Features!

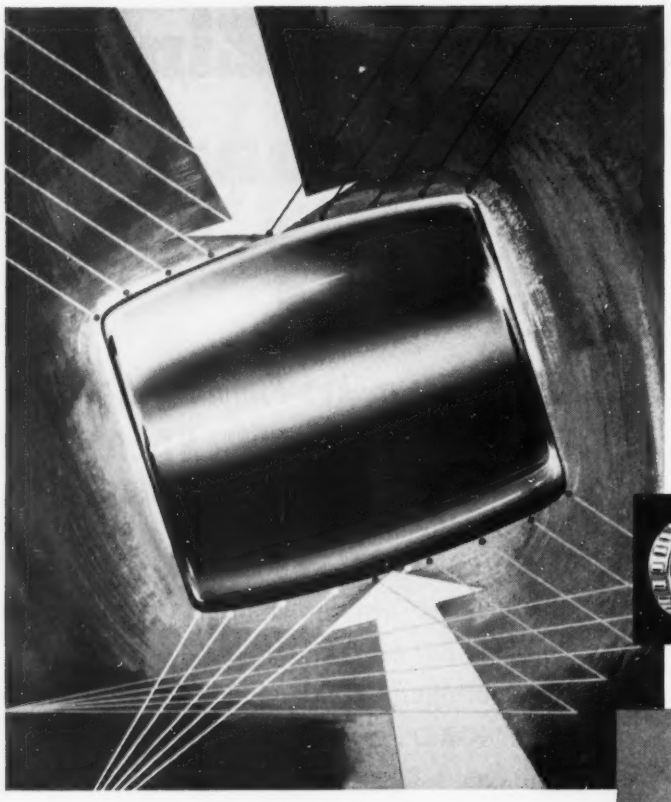
ZINOXIDE contains the finest corrosion resisting pigments known—zinc chromate and oxide! No overspray . . . Perfect adhesion, even to aluminum . . . Dries in minutes . . . Practically eliminates need for sanding . . . No "orange peel" in finish coat!

Get the full ZINOXIDE Primer story now. See how this amazing product can produce lower cost, better looking finishing results *in your* plant. Write today!

THE LOWE BROTHERS COMPANY • Dayton 2, Ohio
Industrial Division

This advertisement is based on facts from Lowe Brothers industrial case history files.

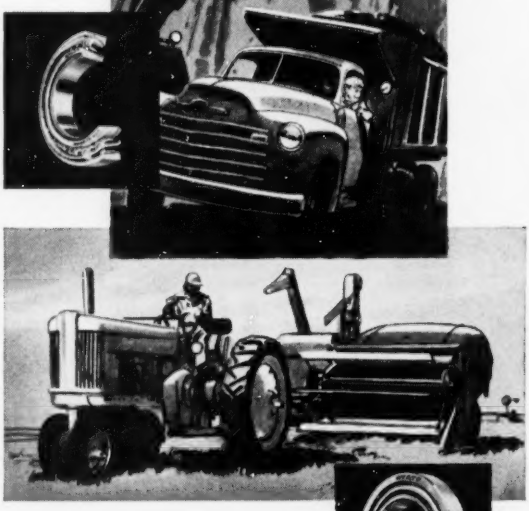
since 1870



A new era in bearings is taking this shape...

NEW HYATT BARREL BEARING

now available in volume!



Industrial designers and engineers seldom make changes in bearing specifications. But when they discover something *really new*—like Hyatt's BARREL BEARING—out come the blueprints! *And this time they know they've got something!* Hyatt's new Barrel Bearing combines dual-purpose design with self-aligning action. It takes load from any direction and operates at full efficiency under conditions of misalignment! And, because barrel-shaped rollers provide high load capacity with low friction, this unique bearing is ideal for a wide range of applications. Best of all, the *cost* is far lower than you would expect! Find out how to improve *your* product . . . Consult a Hyatt Sales-Engineer, or write for our new Barrel Bearing catalog.

HYATT ROLLER BEARINGS

STRAIGHT • BARREL • TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION, HARRISON, N. J.

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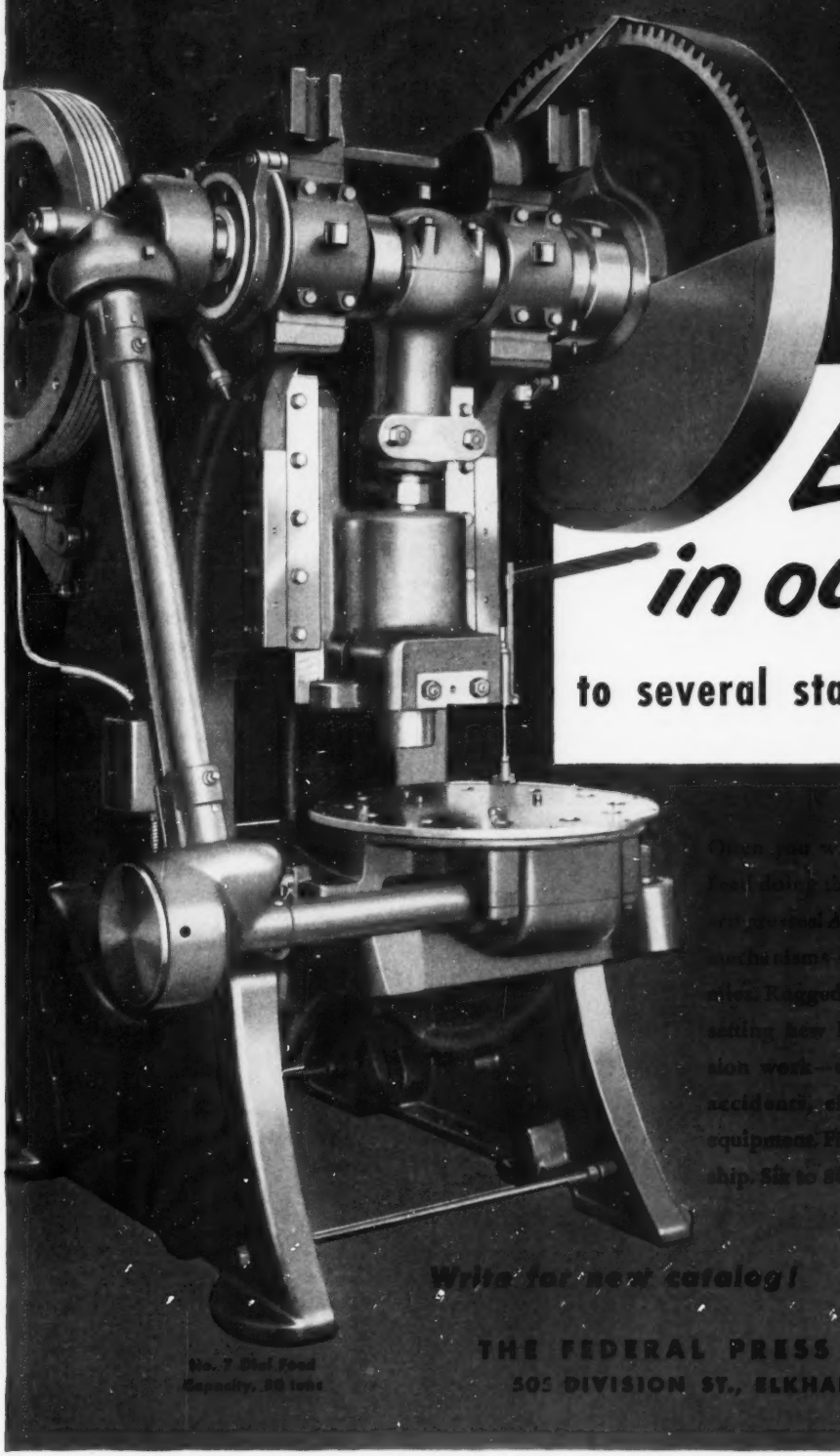
FEDERAL PRESSES

25 YEARS OF QUALITY CONSTRUCTION



Equal in output—

to several standard presses!

Once you will find a single Federal press doing the work of three to five standard presses. Automatic loading and ejection mechanisms provide still further economies. Rugged, precision-built, they're setting new highs in faster, safer, precision work—cutting down-time, reducing accidents, eliminating more expensive equipment. Finest materials and workmanship. Six to 80 tons. Also standard presses.

Write for new catalog!

No. 7 Dial Feed Capacity, 50 tons

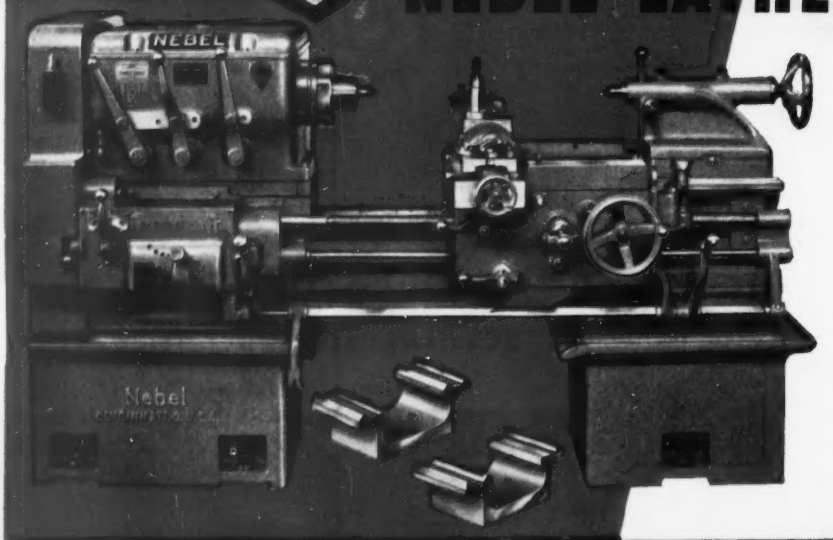
THE FEDERAL PRESS COMPANY

505 DIVISION ST., ELKHART, INDIANA

Big 36" Nebel 'F' series

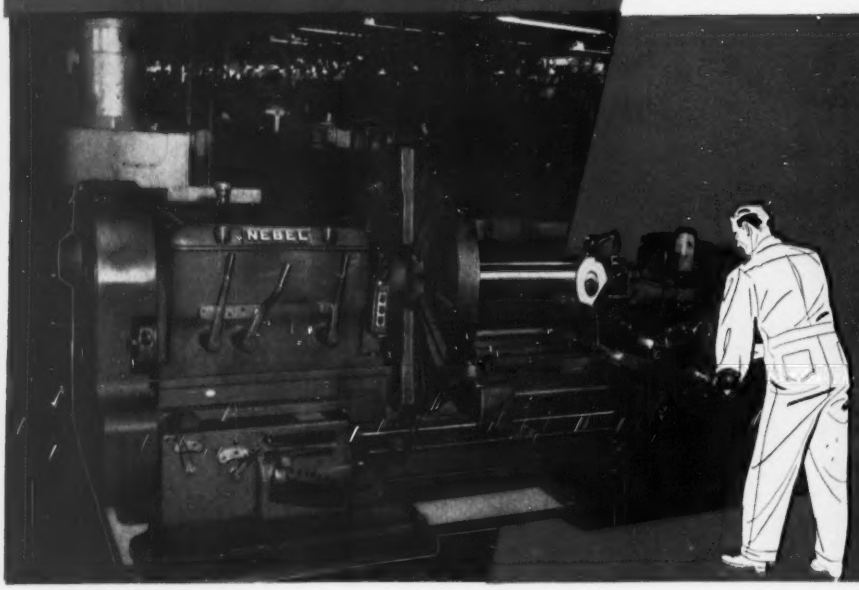
engine lathe turning large jet engine turbine wheel and shaft at Packard Motor Car Co. Other Nebel engine lathes available in swing sizes ranging from 16" to 32".

NEBEL LATHES GIVE YOU..



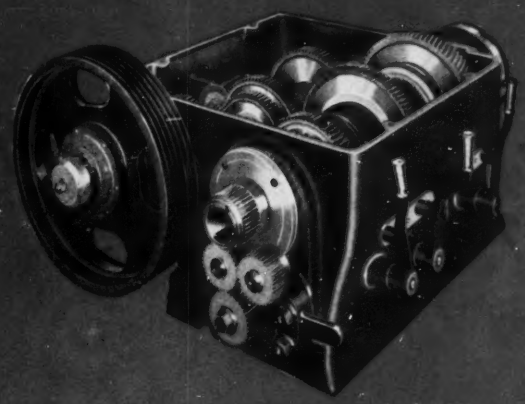
16"/27" Nebel 'LA' series

removable block gap lathe provides extra swing capacity when required. 20"/30" and 25"/40" models also available.



28"/50" Nebel 'G' series

extension bed gap lathe . . . like this one on the job at Eastern Air Lines . . . provides flexible swing and center distance capacity . . . actually performs the work of two ordinary lathes. Also made in 20"/40" size.



Headstock Powerhouse Timken-Equipped

Headstock gears are husky, wide-faced and all are shaved and hardened. Helical drive gears assure smooth, quiet drive. Spindle rolls effortlessly on Timken anti-friction bearings. Spindle speeds obtained through sliding gear combinations and large multiple tooth clutch. A new dynamic brake motor—that stops spindle instantly—is available at additional charge.

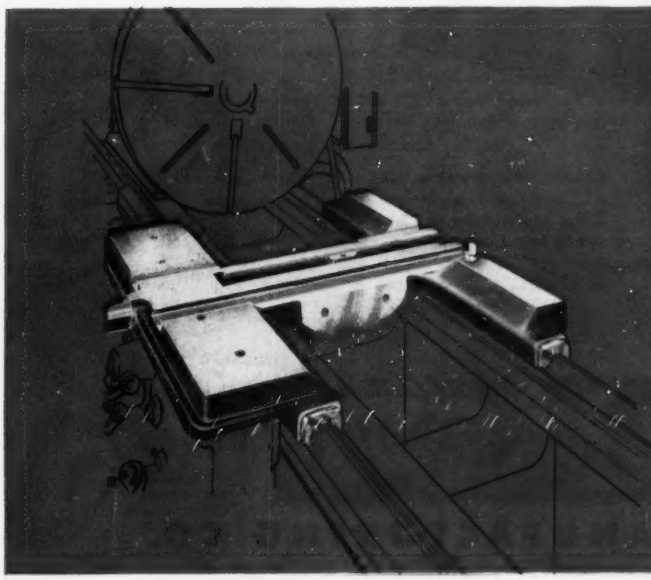
...PERFORMANCE WITHOUT PREMIUM

You pay less for Nebel lathes because they're *basic*. They're not loaded with a lot of expensive 'extras' you may never need. And yet they offer the capacity, power and speed you need for most metal turning. Attachments and accessories are available to round out special, individual requirements.

Nebel lathes are built in three styles: engine lathes, 16″, 20″, 25″, 27″, 32″ and 36″ swing sizes . . . removable block gap lathes, 16″/27″, 20″/30″ and 25″/40″ swing sizes . . . extension bed gap lathes, 20″/40″ and 28″/50″ swing sizes.

Nebel design, construction and operating advantages assure the performance you want. The powerful geared headstock with shaved and hardened gears and Timken anti-friction bearings . . . the unusually long carriage . . . the quick change gear box and double-walled apron with hardened gears . . . are but a few of the reasons why Nebel lathes are so well received by industry.

Buy Nebel for production or maintenance. Either way you'll soon find they're the most useful and the most frequently used lathes in your shop. For complete information, write today for descriptive bulletins.



Nebel

builders of the outstanding shop since 1899

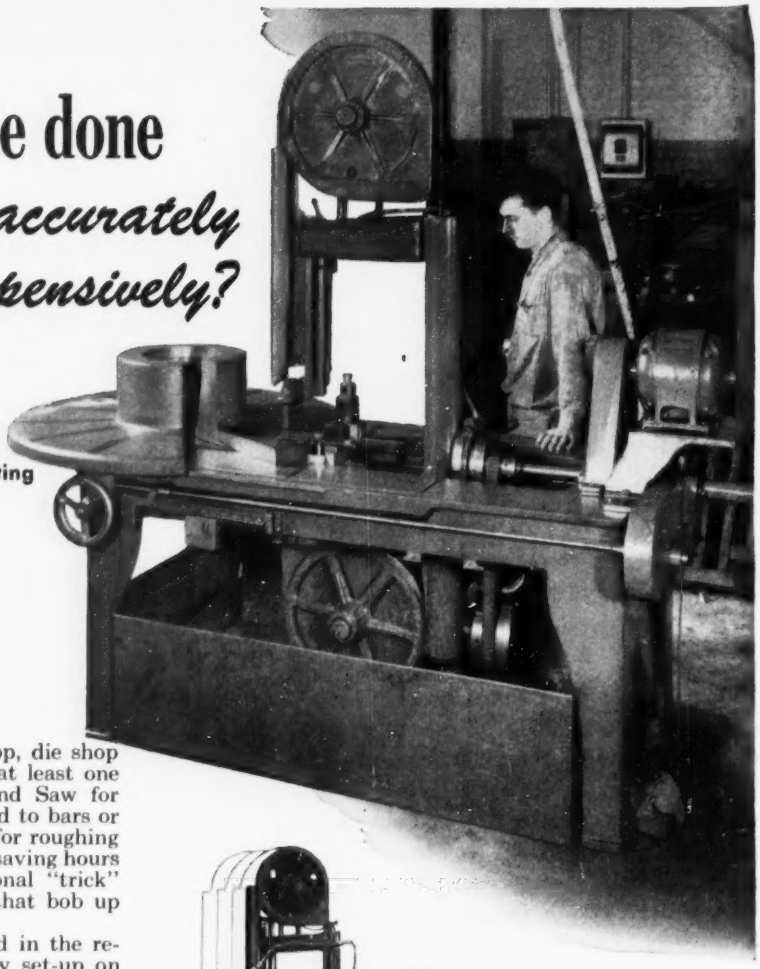
The Nebel Machine Tool Co., Cincinnati 23, Ohio, U.S.A.

Full Bearing Carriage

The Nebel carriage is unusually long and is carefully hand scraped to the two bed v-ways. Takes the full thrust of the cutting tool without budging.

How else could this job be done

so easily, so accurately and so inexpensively?

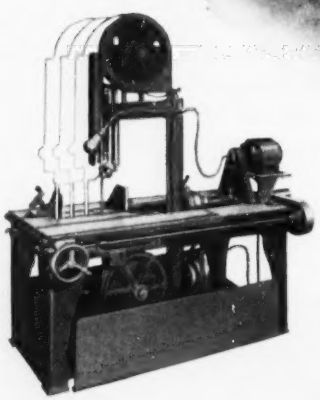


Segmentation of 42″ Steel Casting

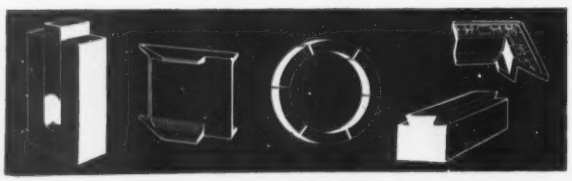
Every tool room, machine shop, die shop and maintenance department needs at least one No. 8 MARVEL Metal-cutting Band Saw for cutting off anything from ⅛″ drill rod to bars or billets of 18″ x 18″ cross-section . . . for roughing large work to size and shape, thereby saving hours of machining . . . for those occasional "trick" jobs, impossible on any other saw, that bob up in every plant.

Odd shapes that can't be held in the removable, quick-action vise, are easily set-up on the No. 8's large, T-slotted work table. MARVEL Overload-Relief Power Feed insures accurate cuts under the most adverse conditions because blade pressures are automatically held within limits which are pre-set instantly for each job. The blade is never forced beyond its capacity to efficiently and accurately remove metal . . .

Close limits are further assured through the work being clamped rigidly to the bed of the saw and the blade power-fed through it instead of pushing the work through the blade. This is also true in miter cutting, as the blade column—*not the work*—is swung to the required angle. The handiest, most versatile machine tool, it is also the busiest in most shops.



This double exposure illustrates how the blade maintains its vertical position while moving into and through the work, impelled by the automatic MARVEL Overload-Relief Power Feed.



Column set at angle to cut 45° miter on 18″ beam. Entire saw column can be swung to cut at any angle from vertical to 45° right or 45° left.

MARVEL *Metal Cutting* **SAWS**

Better Machines–Better Blades

Write for Catalog

ARMSTRONG-BLUM MANUFACTURING CO.

5700 Bloomingdale Avenue *"The Hack Saw People"* **Chicago 39, U. S. A.**

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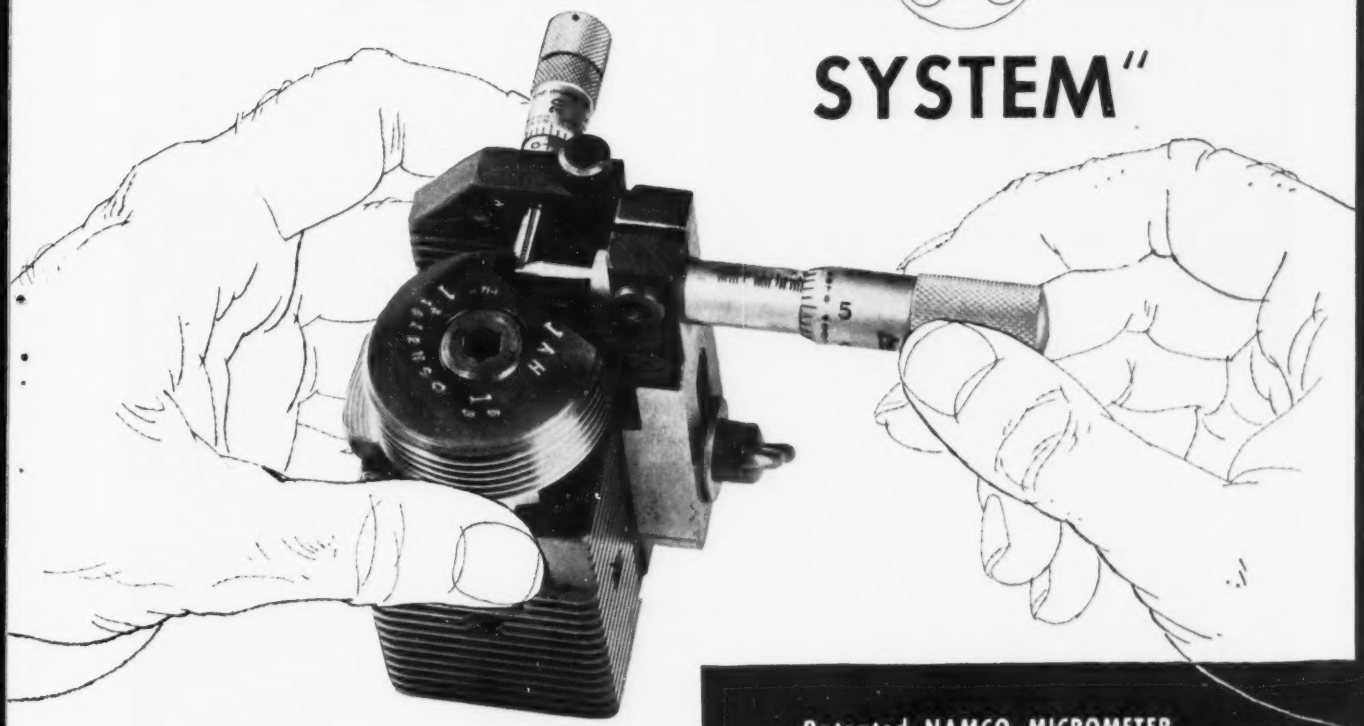
another reason why owners say —

"We use the VERS-O-TOOL SYSTEM"



They call it a "system" because, among other exclusive features, Vers-o-tools are provided with a patented Namco Micrometer that takes the guess-work out of chaser grinding.

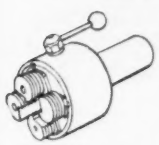
No trial cuts, no adjustments, no time or scrap loss. And by providing an extra set of chasers, kept ground in the toolroom and ready, you put long run jobs on a continuous production basis. Time saved by using this gage frequently adds thousands of precision threads—reduces your costs.

Other Advantages of the System

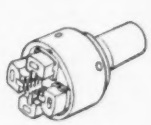
Standard Vers-o-tools use either the famous ground thread circular chasers or the lower cost, adjustable-blade, ground thread chasers—interchangeable die size for die size, in both revolving and non-revolving self-opening heads. The same system applies for end forming and end turning cutters. Use of knurls and rolls is common practice.

Once you start using Vers-o-tools, you are immediately equipped for a more versatile use of threading equipment, at a lower tool investment, than is possible from any other source.

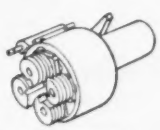
Ask for DT-52, complete new catalog on Vers-o-tool and Namco Solid and Collapsible Taps.



Style DS Vers-o-tool (Non-revolving Type) 10 Sizes, ⅜"—6½".



Style DR Vers-o-tool (Revolving Type) 13 Sizes ⅝"—6½" Shown with Adjustable Blade Chasers 7 Sizes, ⅜"—2".



Style DBS Vers-o-tool (for B&S Automatics) 3 Sizes, ¼"—⅝".

Patented NAMCO MICROMETER takes the guess-work out of chaser grinding

THIS IS THE WAY IT WORKS:

★ Remove chasers from Vers-o-tool head (in one minute) and take a micrometer reading.

★ Regrind them to the same micrometer reading. (Perfect control of the grind is automatic through serrated mounting of circular chasers—rechecking on the gage proves their uniformity.)

★ Replace chasers in head (one minute) with *certainty* that they will cut threads *identical* to those cut on previous grinds.

24-HOUR DELIVERIES ON MOST STANDARD STOCKABLE NC AND NF CHASERS AND BLOCKS — ALSO NATIONAL TAPER PIPE AND DRY SEAL

The NATIONAL ACME CO.

170 EAST 131 STREET, CLEVELAND 8, OHIO.

Acme-Gridley Bar and Chucking Automatics, 1-4-6 and 8-Spindle — Hydraulic Thread Rolling Machines — Automatic Threading Dies and Taps — Limit, Motor Starter and Control Station Switches — Solenoids — Contract Manufacturing

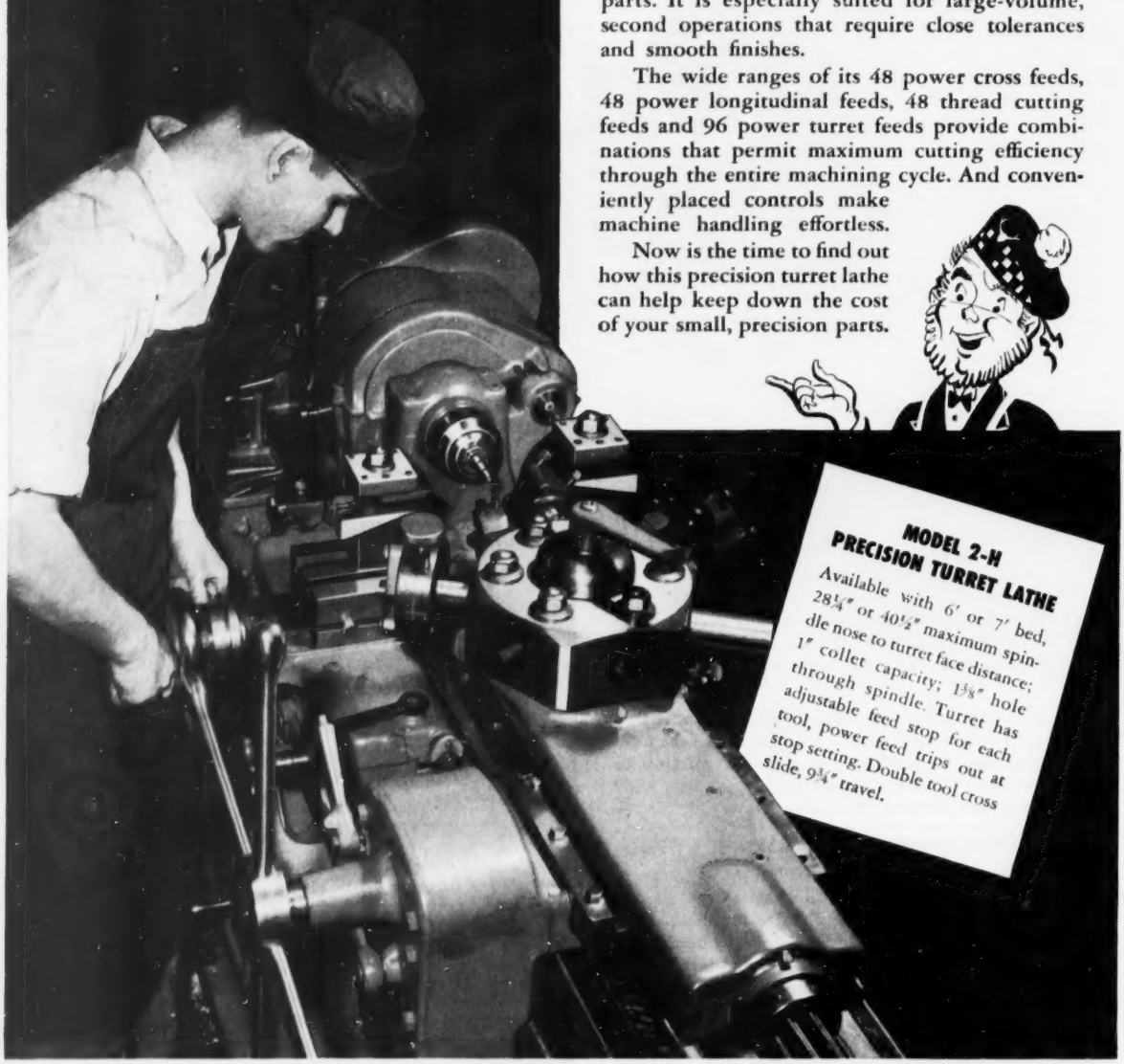
SOUTH BEND 2-H TURRET LATHE

Keeps Costs Down on Precision Parts

This precision-built turret lathe is designed specifically for the machining of accurate, duplicate parts. It is especially suited for large-volume, second operations that require close tolerances and smooth finishes.

The wide ranges of its 48 power cross feeds, 48 power longitudinal feeds, 48 thread cutting feeds and 96 power turret feeds provide combinations that permit maximum cutting efficiency through the entire machining cycle. And conveniently placed controls make machine handling effortless.

Now is the time to find out how this precision turret lathe can help keep down the cost of your small, precision parts.



MODEL 2-H PRECISION TURRET LATHE

Available with 6′ or 7′ bed, 28¼″ or 40½″ maximum spindle nose to turret face distance; 1″ collet capacity; 1⅜″ hole through spindle. Turret has adjustable feed stop for each tool, power feed trips out at stop setting. Double tool cross slide, 9¾″ travel.

Can I get it? When? How?

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

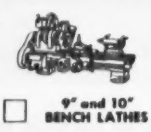
Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

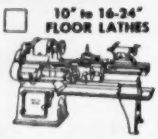
South Bend machine tools with accessories may be purchased on convenient terms up to 12 months.

PLEASE SEND INFORMATION CHECKED:

☐ 9″ and 10″ BENCH LATHES



☐ 10″ to 16-24″ FLOOR LATHES



☐ DRILL PRESSES

☐ 7″ BENCH SHAPERS

☐ TOOL GRINDERS

☐ ½″ & 1″ Collet TURRET LATHES

Name_____ Company _____

Street_____ City & State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

For more information on products advertised, use Inquiry Card, page 261

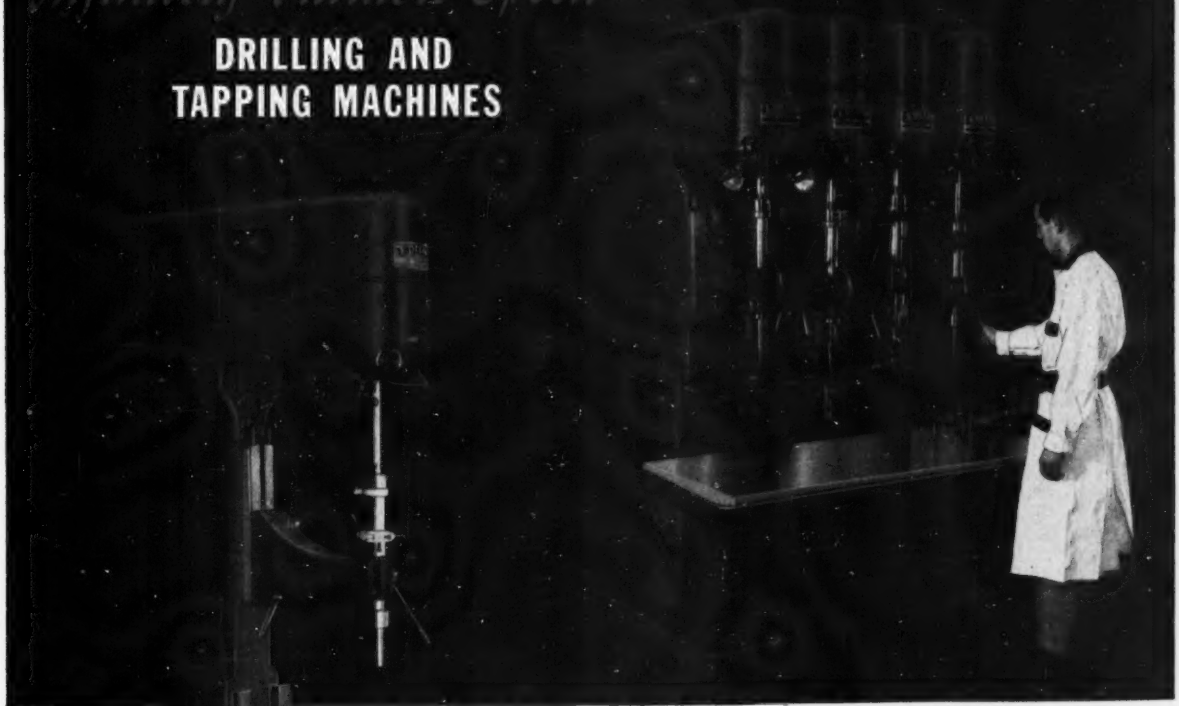
EDLUND

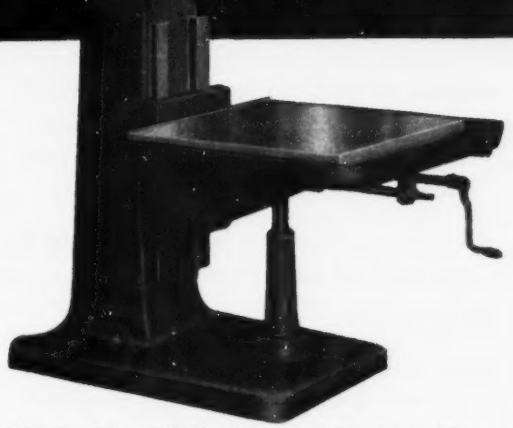
2F

Infinitely Variable Speed

DRILLING AND TAPPING MACHINES

Greatest Advance in Drilling Machines in the Past 25 Years





Variable Speed Model 2F Edlund drilling and tapping machines in standard models to meet your requirements
Spindles: 1, 2, 3, 4, 6, or 8
Speeds: From 50 to 3600 RPM
Overhang: 8" or 15"
Column: Pedestal or Round
Capacity: To 1¼"
Special models engineered to order.
Additional Edlund Equipment: Back Gears (ratio 4 to 1); Semi-Automatic Power Feed; Coolant System; Work Lights; Reversing Motor Tapper; Lead Screw Tapper.

INCREASED PRODUCTION
—25% or more

MAXIMUM TOOL LIFE
—Correct Speed

PRECISION PERFORMANCE
—Rigid Construction

The Edlund new Model 2F with infinitely variable speeds, gives your operator an infinite number of speeds within a broad range—not the ordinary three, four and eight speeds—this means **correct speed for maximum tool life and greatest production.**

Speed changes are made instantly without stopping and valuable production time is not lost changing belts or gears. Convenient controls for easier operation and rigid construction with ample work table area assure precision performance. Here is the advanced-design drilling and tapping machine built under actual tool room and production test conditions for your requirements.

For complete specifications, write for Bulletin 140.

Dealer Representation in Major Cities

EDLUND MACHINERY CO. [A]
DIVISION OF BRADLEY EDLUND CORP.
Cortland, N. Y., U. S. A.

[A] **Affiliated with Precision Castings Co., Inc.**

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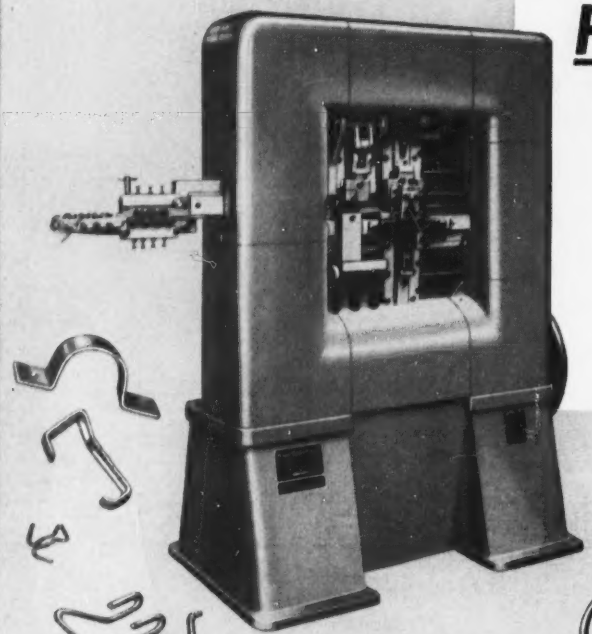
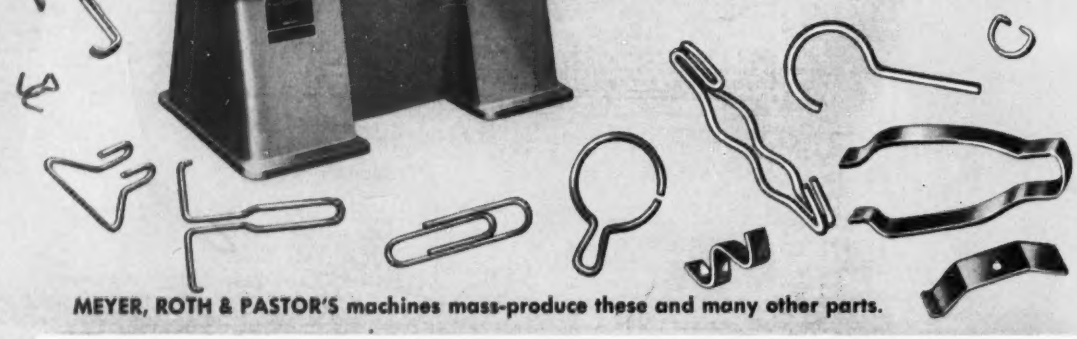
HOW VERSATILE CAN YOU GET?



P-L-E-N-T-Y... with MEYER, ROTH & PASTOR'S WIRE AND STRIP FORMING MACHINE

UNIVERSAL...
AUTOMATIC...
5 SLIDES, OR MORE...



MEYER, ROTH & PASTOR'S machines mass-produce these and many other parts.

- 5 different size machines for fully automatic, economical production of parts from wire coil or strip stock.
- Various sizes produce from 60 to 300 pieces per minute in wire up to .145" diameter or strips up to 25/32" wide.
- Simplified tooling—machine can be quickly re-set to produce different parts.
- Vertical design takes up little floor space.
- Positive and direct control of the bending slides insures high output and trouble-free operation.
- Roller straightening attachment (7 vertical and 7 horizontal rollers) can be opened—you can feed material without disturbing the roller setting.
- Special gripping device insures uniform feed and does not mark wires or strips.
- 3-speed drive.
- Standard equipment includes 4 forming and 1 punching slide and a complete set of tooling. Additional forming slides and attachments, including a blanking and punching attachment, can be supplied.

WRITE FOR BULLETIN

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

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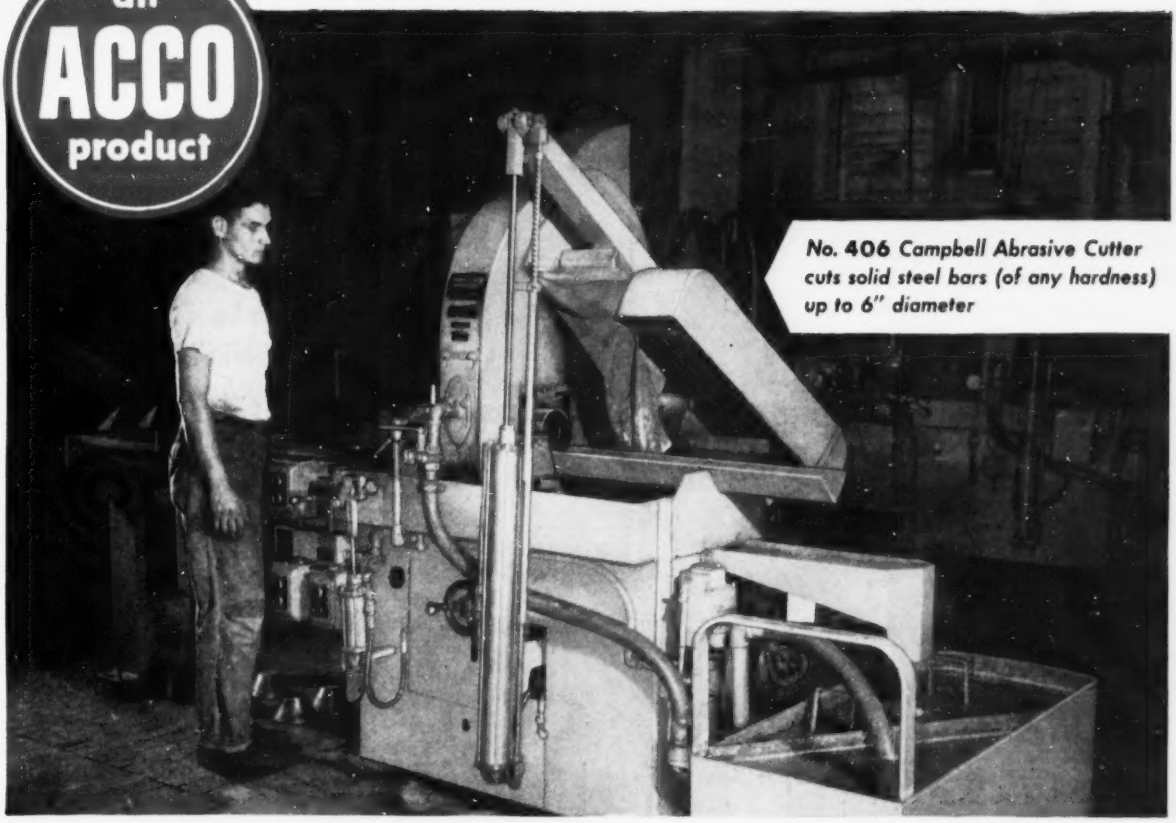
an **ACCO** product



No. 406 Campbell Abrasive Cutter cuts solid steel bars (of any hardness) up to 6" diameter

CAMPBELL Abrasive Cutting Method Sets New Cut-Off Standards

• Recently CAMPBELL was called upon to cut samples of 8" x 8" No. 8740 Chrome Molybdenum steel each taking 210 minutes the old-fashioned way. The buyer was skeptical of the burn-free, smooth, close-tolerance cuts that took only 18 minutes each on the CAMPBELL NO. 480 which takes work up to 8" square. He insisted on seeing the CAMPBELL Cutter in operation cutting his own steel, which he did at a plant of one of our customers. He was convinced and placed his order for a CAMPBELL 480.

• • •

Perhaps you have cutting problems that can be solved with the speed, accuracy and quality of cuts you can get on a CAMPBELL Abrasive Cutter. If so, let us prove what this remarkable machine will do on your own material. Let us show you before your own eyes.

No matter what hardness or shape of metal you must cut repeatedly, if it will fit on one of many sizes of CAMPBELL Abrasive Cutters, which have a range up to 8" diameter solids and 20" diameter tubular, we'll show you how to cut it faster and better. Write today for "*Principles of Abrasive Cutting.*" Give us the material specifications and we'll be glad to make recommendations.

ACCO

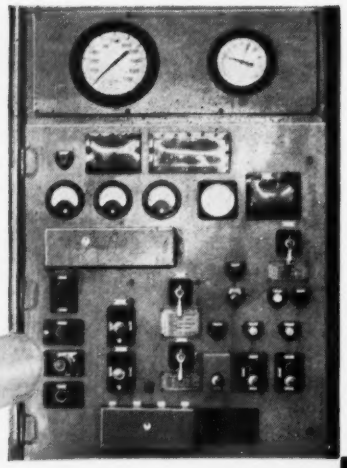
TRADE MARK

CAMPBELL MACHINE DIVISION
AMERICAN CHAIN & CABLE

925 Connecticut Ave., Bridgeport 2, Conn.

CAMPBELL
Abrasive Cutters and Nibblers

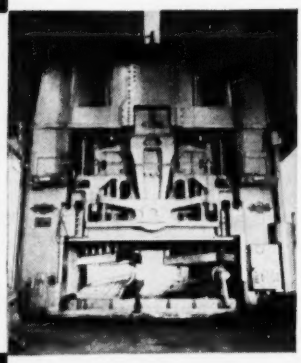
16 million pound squeeze..



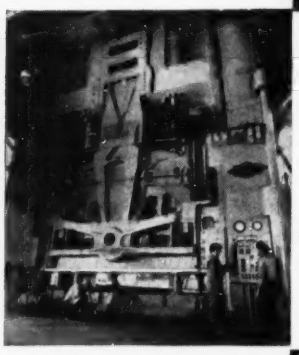
The world's largest hydraulic press of its kind . . . in operation in Lockheed's Hall of Giants

helps Lockheed bring costs down . . . plane strength up!

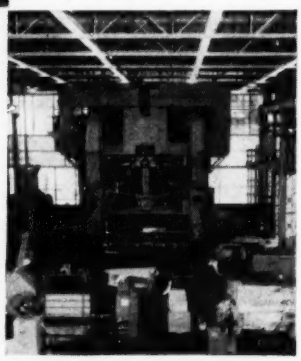
Today, Lockheed Aviation Corporation in Burbank, California, is meeting the demands of tomorrow's high speed aircraft by producing larger individual parts with heavier sections of new, tougher metals. At the touch of a button, the operator of this 8,000-ton Birdsboro hydraulic press controls a force equivalent to the weight of a battle cruiser.



Workers remove plane sections from the jaws of this 48-foot hydraulic press designed and built by BIRDSBORO.



From 12 feet below floor level to the ceiling stands THE BIGGEST GIANT OF THEM ALL.



On a volume production basis, this huge press is capable of forming sections up to 10 x 30 feet in half-inch aluminum.

designed & built by **BIRDSBORO**

BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA. HYDRAULIC PRESSES

HP 14-53

Offices in Birdsboro, Pa. and Pittsburgh, Pa.

• ***designers and builders of:*** Hydraulic Presses • Steel Mill Machinery • Crushing Machinery • Rolls • Special Machinery • Steel Castings

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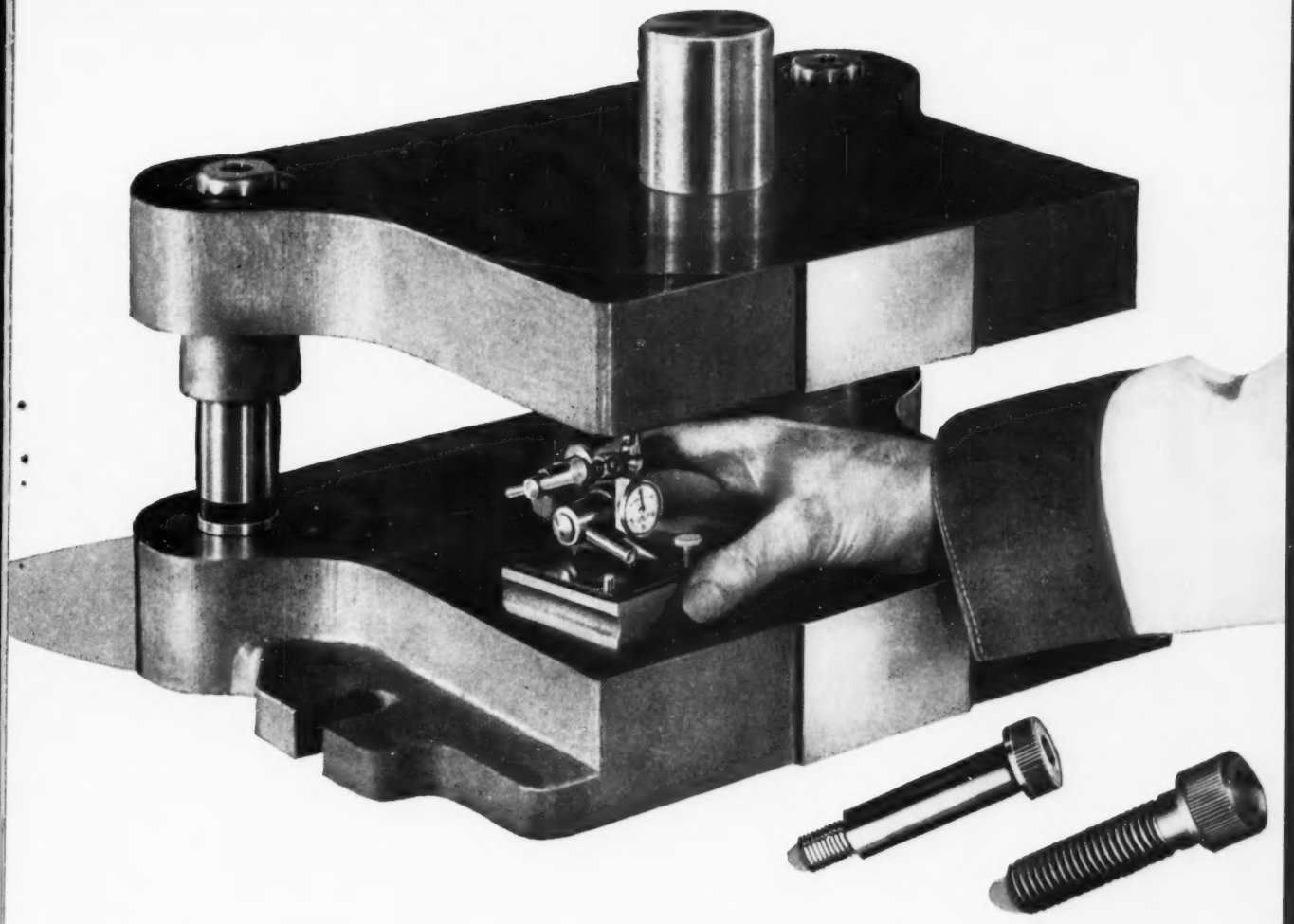

DIEMAKERS DEPEND ON DANLY FOR DIE SET ACCURACY

When it comes to meeting the precision requirements of the finest die work, diemakers everywhere *depend on Danly* Die Sets and Danly Diemakers' Supplies for accuracy. Precision machining, grinding, lapping and honing provide smooth, long-wearing surfaces with dimensional accuracy held within extremely close tolerances. On every component part, rigid inspection standards guard Danly quality.

Danly accuracy saves countless hours in the die shop, makes tooling-up much faster, insures longer production runs at lower cost. Why not bring Danly into your diemaking plans and get the results you're looking for. Remember, there's a Danly Branch near you. They're stocked for immediate delivery.

Call Your Local Danly Branch Today!

***CHICAGO** 50—2100 S. Laramie Ave.
***CLEVELAND** 14—1550 East 33rd St.
***DAYTON** 7—3196 Delphos Ave.
***DETROIT** 16—1549 Temple Ave.
***GRAND RAPIDS**
113 Michigan St., N.W.
INDIANAPOLIS 4—5 West 10th St.
***LONG ISLAND CITY**—47-28 37th St.
***LOS ANGELES** 54—Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2—111 E. Wisconsin Ave.
***PHILADELPHIA** 40
511 W. Courtland St.
***ROCHESTER** 6—33 Rutter St.

**Indicates complete stock*

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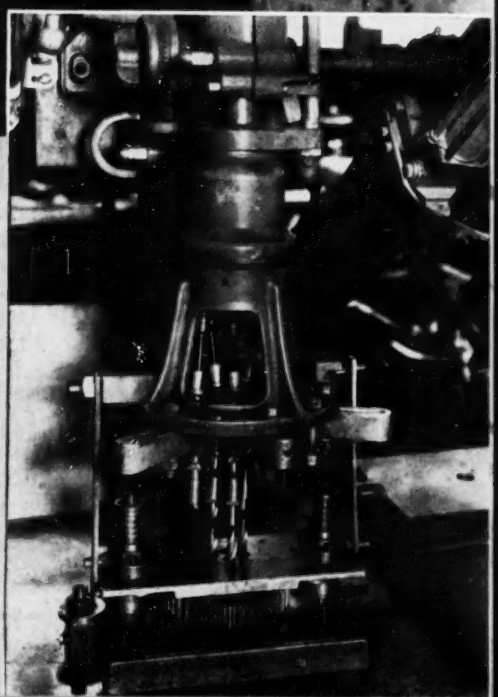
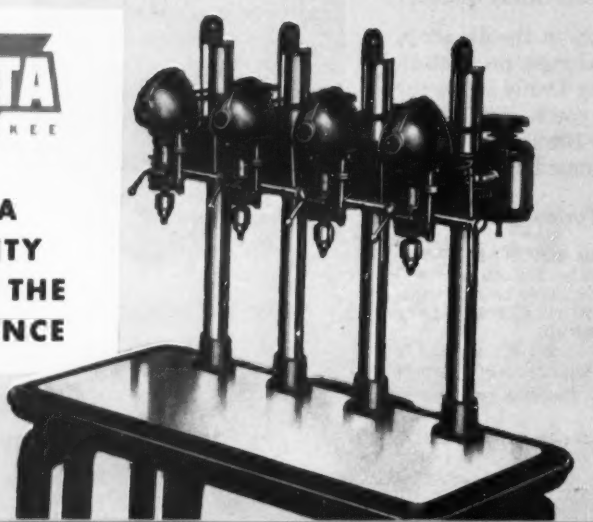
Our Production Jumped



DELTA
MILWAUKEE

DELTA QUALITY MAKES THE DIFFERENCE



300% with our First

DELTA Drill Press

says CHARLES LASLO, Superintendent, CLOYES GEAR WORKS, Cleveland, Ohio

4-spindle 14″ drill press drills 4 to 6 holes at one time in timing gears—Chamfering is free operation—Machine used 30-40 hours per week, maintenance negligible.

- ***Another example of improved direct labor efficiency by using DELTA tools***

"In our pre-Delta era," says Mr. Laslo, "we used a 4-spindle drilling machine with flat-belt drive to drill and chamfer holes in timing gears used by leading auto builders. Belt slippage lost a lot of production and belt maintenance was high. Pieces were held by hand, and precision tolerances were hard to maintain.

"We bought a Delta 4-spindle, 14″ drill press to do the combined drilling and chamfering operation on the gears. The No. 1 spindle was equipped with a fixture to hold the work, a multiple spindle head to do all the drilling, and a power feed.

"Chamfering became a 'free' operation because, while the No. 1 spindle goes through its automatic cycle, the operator chamfers the already-drilled piece from the previous cycle, puts it in the finished stock box, and gets a new piece ready.

"These operations are absolutely cost-free from a labor standpoint—compared with the old method.

"Also when time studies on one product proved that handling operations accounted for ⅓ of total cost, we installed another Delta single-spindle 14″ drill press mounted on a wheel-equipped table. By moving the tool we eliminated most of the moving of the work.

"Recently, to deal with heavier volume we bought a Delta 17″ drill press that drills 1/16″ and 27/64″ holes with extraordinary efficiency and accuracy."

Results speak for themselves:

- **Quality greatly improved—fewer rejects**
- **Operations eliminated**
- ***Production quadrupled***

Thousands of other Delta users are getting the same labor savings from multiple set ups that include the Delta 17″ power feed drill press.

Can you win new "highs" in volume and quality? —most likely, yes! It's surely worth a little no-cost exploration. Talk to your Delta dealer—listed in the classified pages of your phone book under "Tools" or "Machinery"; and use the coupon to get the latest Delta AB-52 Catalog.

DELTA QUALITY POWER TOOLS

Another Product of **Rockwell**

Delta Power Tool Division
Rockwell Manufacturing Company
614L N. Lexington Ave., Pittsburgh 8, Pa.

( ) Please send me the name of my nearest Delta dealer
( ) Please send me the latest AB-52 catalog

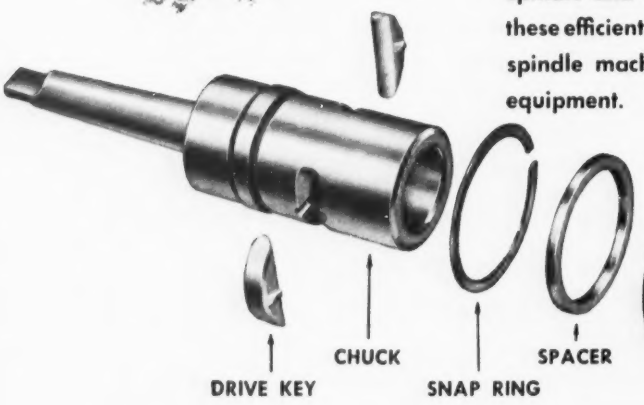
Name _____
Position _____
Company _____
Street _____
City _____ Zone ____ State ____

IT COSTS YOU MONEY.....

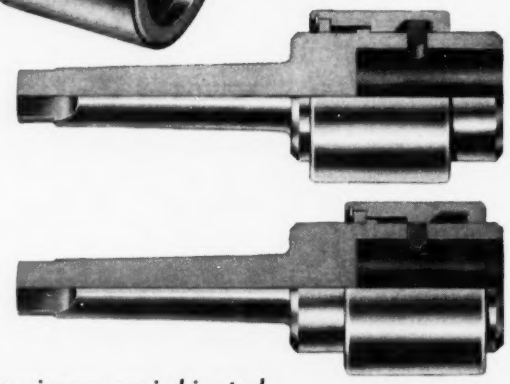
. . to press this button!

Beaver PRECISION RAPID DRILL CHUCKS AND COLLETS ELIMINATE COSTLY DOWN-TIME!

You can change Beaver Precision Collets in Beaver Precision Rapid Drill Chucks without stopping the machine spindle and with absolute safety to the operator. With these efficient, sturdy, economical Beaver Tools your single spindle machine will do the work of multiple spindle equipment.



The three views show the construction of the Beaver Precision Collet (above), and the design of the Beaver Precision Rapid Drill Chuck (below).



In Beaver Precision Rapid Drill Chucks, the collets are locked securely and driven by hardened steel drive keys extending entirely across both sides of the collet. All parts are hardened and ground to take maximum loads on high-powered, modern machines. They're precision-built for alignment, concentricity, and overall accuracy. Use Beaver Tools—test their superiority for yourself.

Beaver Standard Machine Tool Accessories are carried in stock.

Beaver TOOL AND ENGINEERING CORPORATION

BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648

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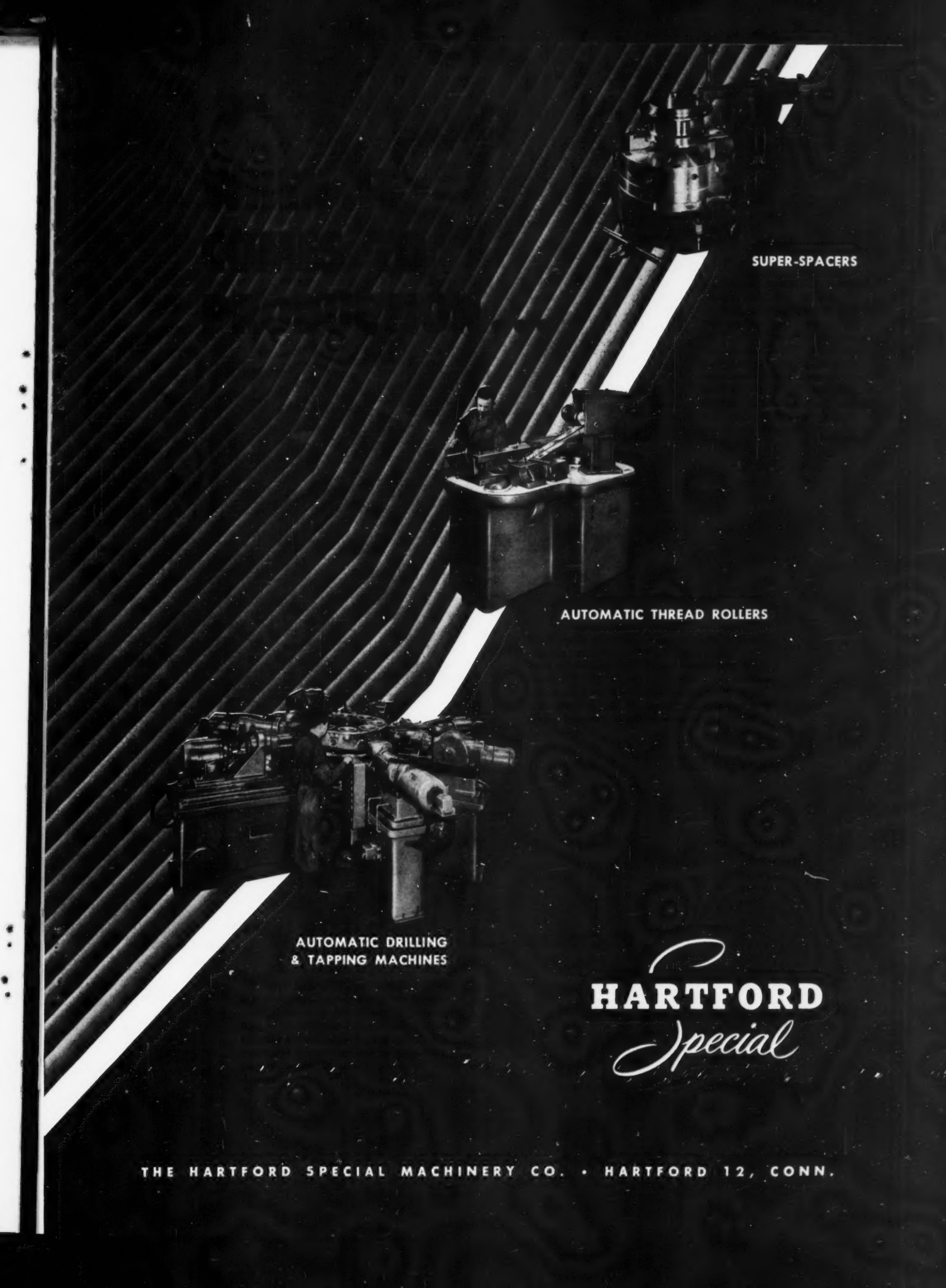
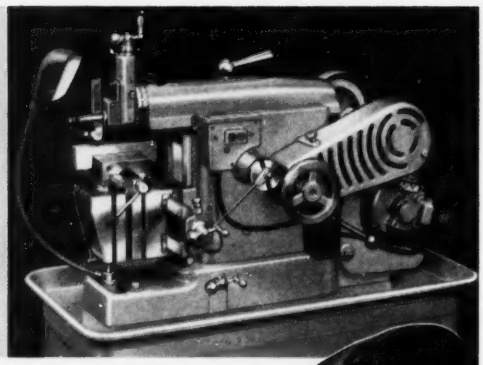

SUPER-SPACERS
AUTOMATIC THREAD ROLLERS
AUTOMATIC DRILLING
& TAPPING MACHINES
HARTFORD
Special
THE HARTFORD SPECIAL MACHINERY CO. • HARTFORD 12, CONN.

South Bend 7" Shaper

FAST · EFFICIENT · ECONOMICAL!

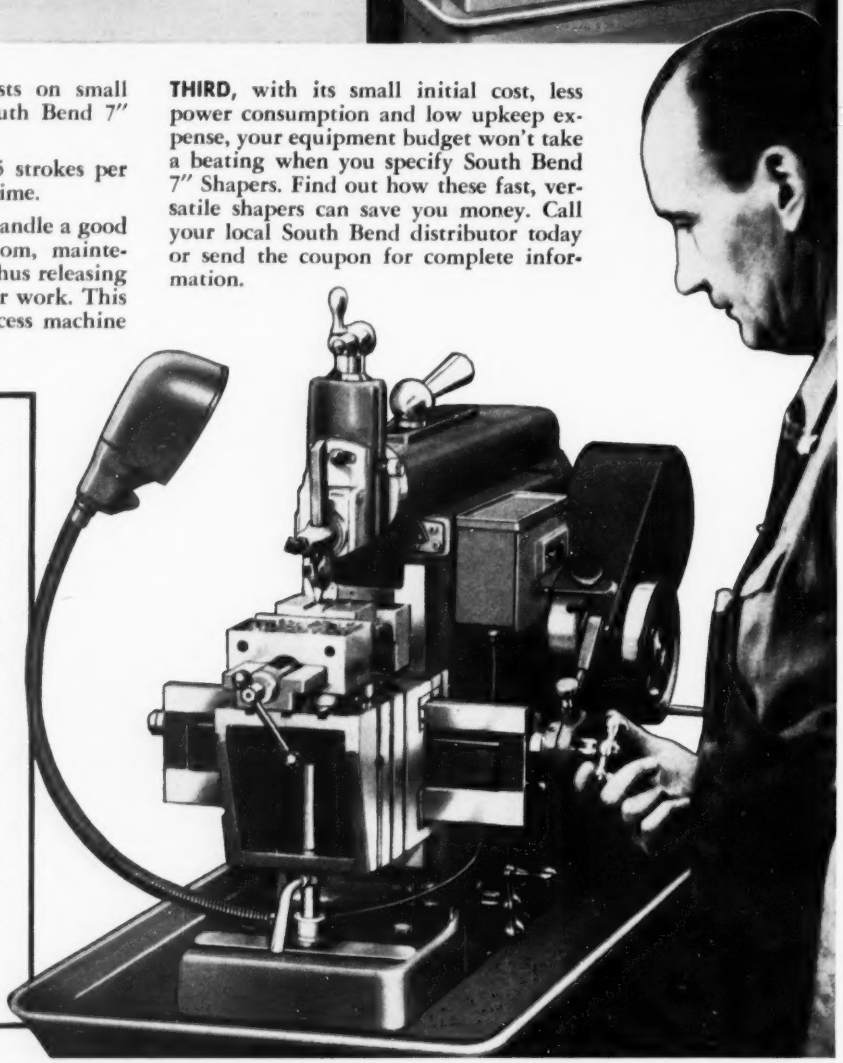


Watch your machining costs on small work go down when a South Bend 7" Shaper takes over.

FIRST, its speed — 42 to 195 strokes per minute reduces machining time.

SECOND, its 7" stroke will handle a good share of your small toolroom, maintenance and production jobs thus releasing your heavy shapers for larger work. This stops the waste of using excess machine capacity on small jobs.

THIRD, with its small initial cost, less power consumption and low upkeep expense, your equipment budget won't take a beating when you specify South Bend 7" Shapers. Find out how these fast, versatile shapers can save you money. Call your local South Bend distributor today or send the coupon for complete information.



SPECIFICATIONS

RAM

Stroke length . . . . . 0 to 7"
Strokes per min. (4) . . . 42 to 195
Cutting speeds . . . 3 to 114 feet per minute

TOOL HEAD

Vertical travel . . . . . 3"
Tool post slot . . . . . 3/8" x 7/8"
Head swivels . . . . . 360°
Clapper swivels . . . . . 35°

TABLE

Vertical travel . . . . . 5"
Horizontal travel . . . . . 9½"
Power cross feeds (6) . . . . . .002" to .012" (reversible)
Size . . . . . 6 5/16" x 5" x 5 3/8"
Distance from ram . . . ½" to 5½"

VISE

Maximum opening . . . . . 4"
Jaw width . . . . . 4"
Jaw depth . . . . . 1"
Height over table . . . . . 2 1/16"

MOTOR

⅓ or ½ h.p.

Can I get it? When? How?

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

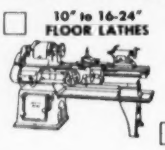
Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

South Bend machine tools with accessories may be purchased on convenient terms up to 12 months.

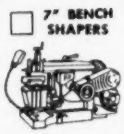
PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES



☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES



☐ 7" BENCH SHAPERS

☐ TOOL GRINDERS

☐ ½" & 1" Collet TURRET LATHES

Name _____ Company _____

Street _____ City & State _____

SOUTH BEND

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

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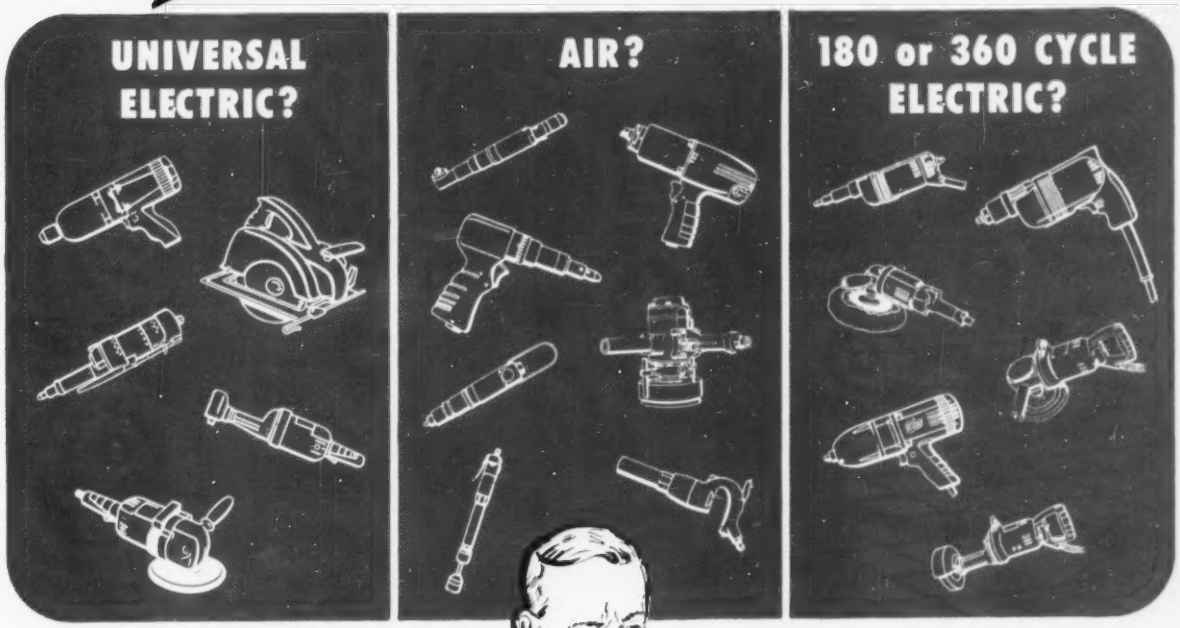
Thor HAS THE ANSWERS!



Produce More at Lower Cost With Portable Power Tools

60 years in the business, with over 1,500 different types of power tools available, *THOR POWER TOOL COMPANY* is well qualified to give you sound, impartial advice on *ALL* portable power tool problems. *Thor—and* only *Thor—specializes exclusively in the manufacture of portable power tools . . . of ALL types.*

For money-saving, cost-cutting *IDEAS*, write for Thor Power Tool Catalogs or a "get acquainted" call from a Thor service engineer. Thor Power Tool Company, Aurora, Ill. *Sales and Service Offices in Principal Cities.*

YOUR FILES ARE INCOMPLETE if you do not have the latest Thor Tool catalogs covering Thor Air Tools, Thor Universal Electric Tools, Thor 180 Cycle and 360 Cycle High Frequency Electric Tools. Use coupon below.

Thor TOOLS
THOR POWER TOOL COMPANY
Aurora, Illinois

UNIVERSAL ELECTRIC	Augers	Core Busters	Lubricators	Rivet Busters	Spike Drivers
	Backfill Tampers	Couplings	Nail Drivers	Rivet Squeezers	Tappers
	Balancers	Feed Mechanisms	Nut Setters	Rock Drills	Valve Refacers
AIR	Belt Sanders	Fender Hammers	Paving Breakers	Sanders	Valve Seat Grinders
	Bench Grinders	Files	Pin Drivers	Saws	Wire Brush Machines
	Chisels	Grinders	Polishers	Scaling Hammers	Wood Borers
HIGH FREQUENCY ELECTRIC	Chipping Hammers	Hammers	Pumps	Screwdrivers	
	Clay Diggers	Hoists	Rammers	Sheet Metal Nibblers	
		Impact Wrenches	Reamers		

THOR POWER TOOL COMPANY
Aurora, Illinois

Please send catalog covering Thor
- ☐ Air Tools ☐ Universal Electric Tools
- ☐ 180 Cycle High Frequency Electric Tools
- ☐ 360 Cycle High Frequency Electric Tools
- ☐ Please have your service engineer call

Your Name_____

Company_____

Street_____

City & State_____

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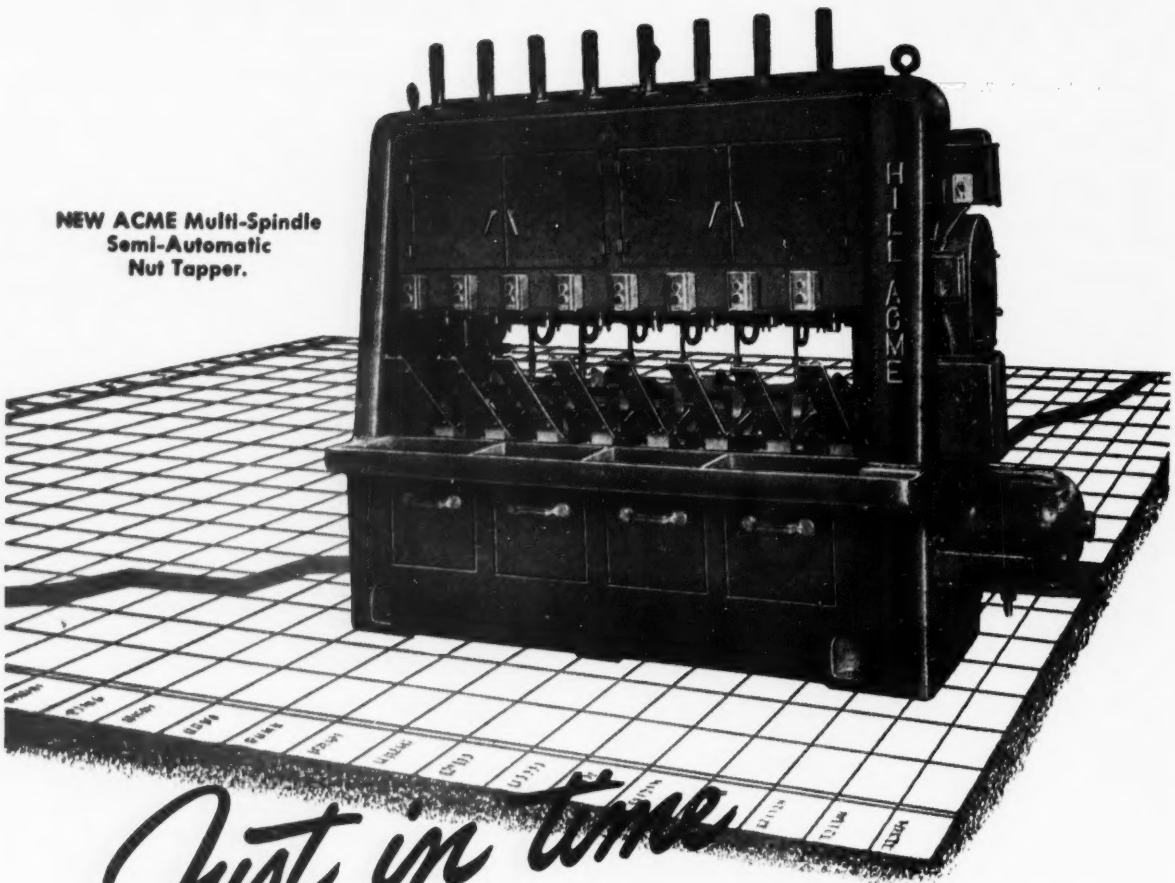

NEW ACME Multi-Spindle Semi-Automatic Nut Tapper.

Just in time

TO HELP YOU INCREASE PRODUCTION

Redesigned just in time to meet the needs of increased production in your plant, this ACME Model XWT eight spindle nut tapper will not only step up production but because of semi-automatic operation, will greatly reduce operator fatigue. Built in 6 and 8 spindle models in 1″ and 2″ capacities. The same machine can also be adapted for tapping couplings. Delivery schedules are reasonable.

FEATURES

1. Conveniently located push buttons operate the spindles.
2. Hydraulically controlled spindle cycle.
3. Repeat cycle is automatic.
4. Adjustments for change of cycle are quick and easy.
5. Change gears running in oil bath easily replaced for different spindle speeds.
6. Silent operation.
7. Worm drive in spindles.
8. Anti-friction bearings.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1203 W. 65th St., Cleveland 2, Ohio
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

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FOR THOSE TOUGH Special JOBS
DEPEND ON

National Tool Co.

● **Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* cutting tools call in your National Tool Co. representative. He is backed by more than 46 years experience in the engineering and manufacture of *special* cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.**

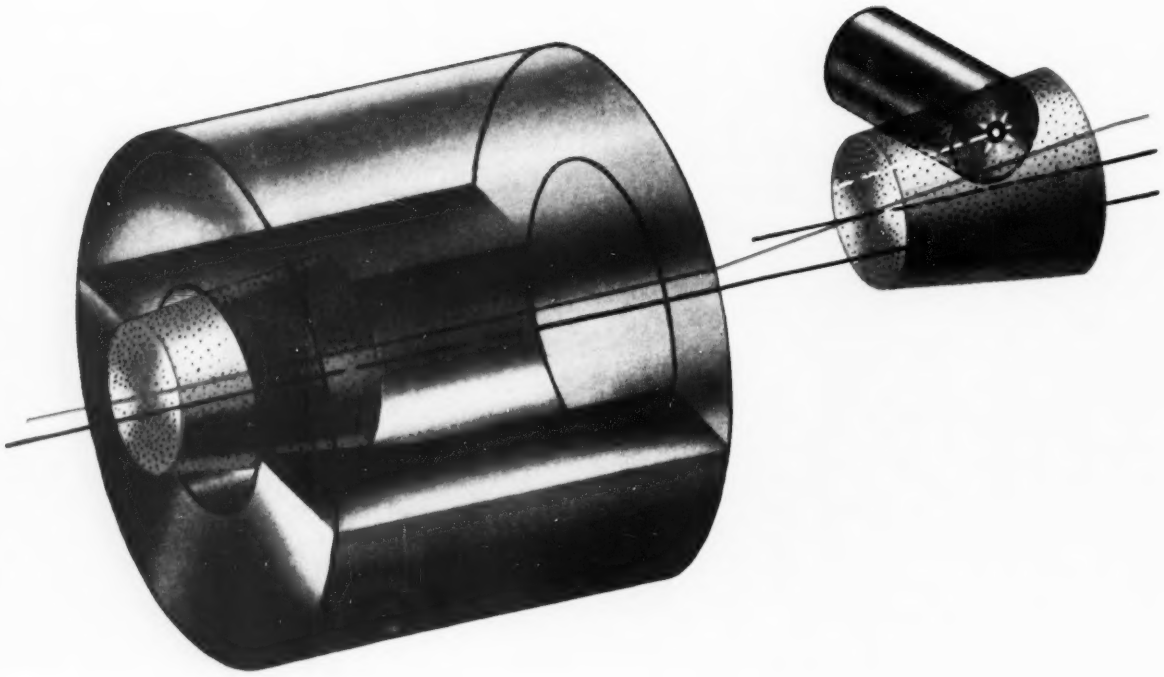
Since 1905 **engineers and manufacturers of high-quality special cutting tools for the metal-working industry**

NATIONAL Tools CLEVELAND

National
TOOL CO.
Cleveland 2, Ohio

alignment

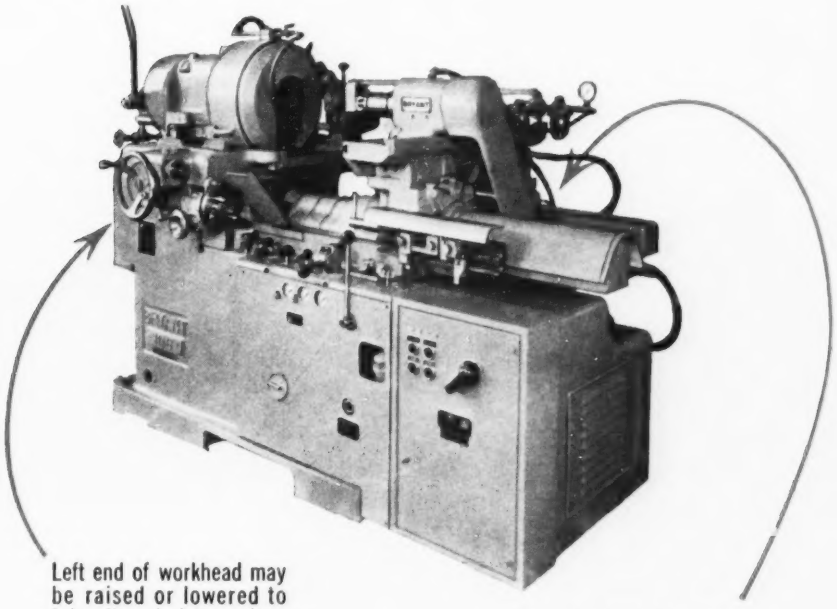
for better internal grinding



IT is common assumption in internal grinding that once the grinding wheel passes the diamond, all errors will be eliminated and the wheel will be a perfect cylinder. It is also assumed that this grinding wheel can produce a straight hole. These two assumptions are true if the wheel path is a straight line parallel with the axis of the wheel as it passes the diamond and traverses the work.

In the illustration, the wheel slides are badly worn and the wheel path is not a straight line. The distortion in the ways causes the wheel to move gradually away from the diamond and the wheel is dressed to a taper as it passes the diamond. Then, as the tapered wheel traverses the work, it will grind only on its large diameter. At the point of reversal the tapered form will be transferred to the work. If the traverse stroke is lengthened, the tapered section will be moved to the new point of reversal. In addition, wheel wear will be excessive, finish will be poor, feed lines may be visible.

Available information advises simply turning the workhead or changing the length of traverse to correct taper. In the case illustrated, neither turning the workhead nor changing the length of traverse will produce a straight hole. The only possible remedy is to straighten the wheel slide ways which will, in turn, straighten the wheel path. The wheel will then contact the work properly, producing correct geometry of the hole, longer wheel life and better finish.



Left end of workhead may be raised or lowered to bring its axis into a plane parallel with wheelslide bar.

Rear of wheelslide may be adjusted to insure straight line motion of the wheel.

This machine is for general purpose hole grinding. It has convenient centralized controls and all features necessary to handle a variety of work with minimum time and effort needed for changing jobs. For stable 3-point support, the wheel spindle is mounted on a cylindrical bar which is supported on 2 cylindrical bearings. The rear of the slide is supported on a hardened and ground guide plate. Workhead may be swiveled for grinding tapers up to 90° included angle. Provision is made for mounting a face grinding spindle in addition to the hole grinding spindle. The No. 1116 will swing 16″ with 12″ max. hole depth. Write for folder.

Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie — free showings arranged for engineering groups.

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Boring Machines

VK HIGH SPEED STEEL THREAD MEASURING WIRES

...basic tools in a universally accepted method of checking screw threads

VK Set No. 20 HS Thread Measuring Wires, accurate to ±.000025" for 20 common pitch Unified and American screw threads, 6 to 36 threads per inch.

The three-wire method is probably the best known and most widely accepted system of measuring pitch diameter of screw threads. Equipment required includes only a set of VK Thread Measuring Wires of proper diameter and an accurate measuring instrument.

Van Keuren Thread Measuring Wires have been developed over a period of many years of pioneering in the precise measurement field. They are made to National Bureau of Standards specifications, are held within .00002" for roundness, straightness and identity and to within .000025" of exact size.

VK Thread Measuring Wires are made of long-wearing, tough and beautifully finished high speed steel and are either 1-7/8" or 2" in length. Every wire is subjected to the closest criteria in today's standards of accuracy.

In addition to set No. 20, shown here, VK furnishes many other standard sets as well as special wires in diameters from .001" to 1.500".

The Van Keuren Catalog and Handbook No. 35 contains 91 pages of technical and engineering information on wire measurement of screw threads. This information, compiled from many years' research in the field, is available without charge by addressing: The Van Keuren Co., 178 Waltham Street, Watertown, Mass.

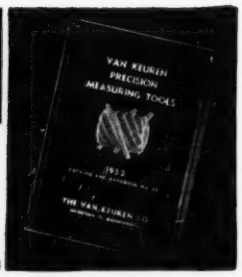
VK

34th YEAR

THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages



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WANT TO REDUCE COSTS PER PIECE?

FROSTRODE removes excess heat from the coolant!

Frostrode Coolant Coolers Will Give You–

- LONGER TOOL LIFE WITH LESS MAINTENANCE
- IMPROVED SURFACE FINISH
- INCREASED RATE OF PRODUCTION
- REDUCTION OF REJECTS

Users of Frostrode Coolant Coolers have recorded amazing increases in efficiency.

"If you can pump it FROSTRODE can cool it"

Write for examples of FROSTRODE installations applied to machine tools–BULLETIN 502

FROSTRODE DIVISION OF VIKING PRODUCTS

3066 EAST OUTER DRIVE • DETROIT 34, MICHIGAN

For more information on products advertised, use Inquiry Card, page 261

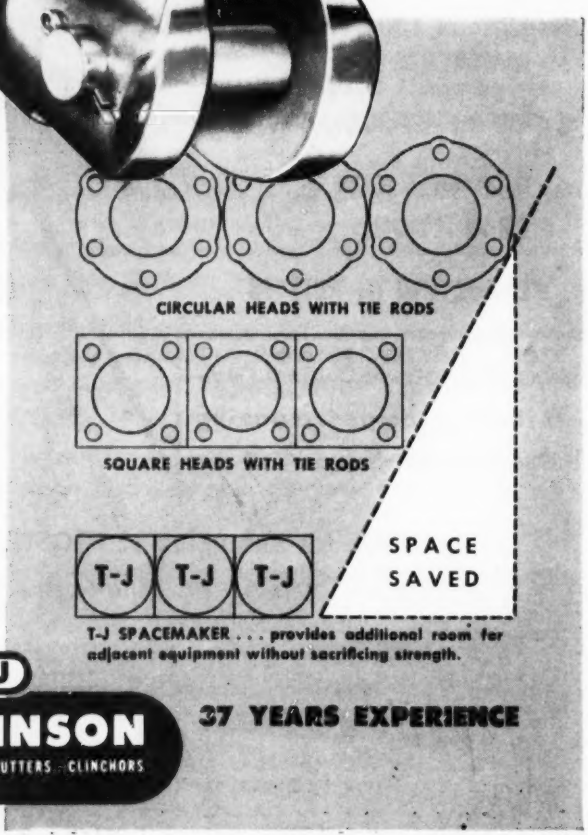
LESS SPACE!

extra high safety factor!

NEW T-J Spacemaker AIR CYLINDERS

These new T-J Cylinders *save up to 40% in mounting space*—with streamlined design that eliminates tie rods. They're *super rugged*—extra high safety factor . . . solid steel heads . . . heavy wall, precision honed, hard chrome plated, seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, hi-tensile, hard chrome plated piston rod.

Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . for pushing, pulling, lifting, clamping or control jobs. T-J dependability. Write for bulletin 8152. The Tomkins-Johnson Co., Jackson, Mich.



T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

4 Weeks Delivery on the Spacemaker— any style, any stroke, 1" to 3" diam.

T-J

TOMKINS-JOHNSON

RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

37 YEARS EXPERIENCE

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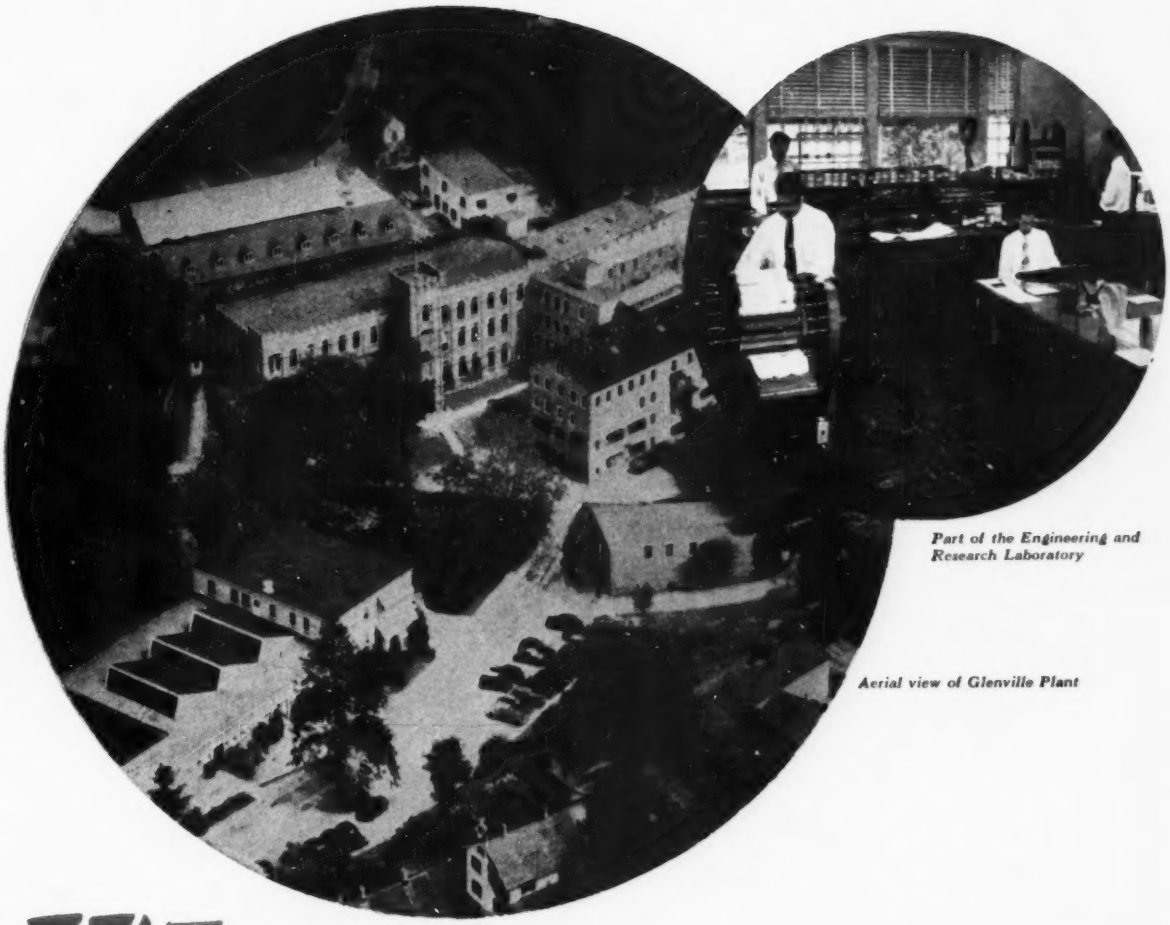


Part of the Engineering and Research Laboratory

Aerial view of Glenville Plant

FELT problems are welcomed here —AND SOLVED!

American makes felt in actually hundreds of different types, each having carefully-controlled characteristics. Felt, you see, is not just felt, but is an engineering material, which can be, and should be, selected and specified as closely as any other material.

American is keenly progressive and has a vast knowledge of all types of natural and synthetic fibres. Felt is now engineered into the various end uses. Our knowledge is freely available to you, through our sales staff, or from the Engineering and Research Laboratory.

How important it is to obtain the right felt is illustrated by the case of a customer who insisted on "saving money" by buying a felt which we insisted was not suitable for the application. In the end, the saving produced a loss, and the customer, having learned the hard way, now relies upon our advice. You can avoid such trouble by bringing your needs for felt to American. Tell us what the felt is to be used for, whether in a process or a product, and we will help you select the right type.

And remember, American operates cutting shops in Glenville, Conn., Detroit, Mich., San Francisco, Calif., which can quickly produce cut felt parts, ready for assembly, to speed your output.

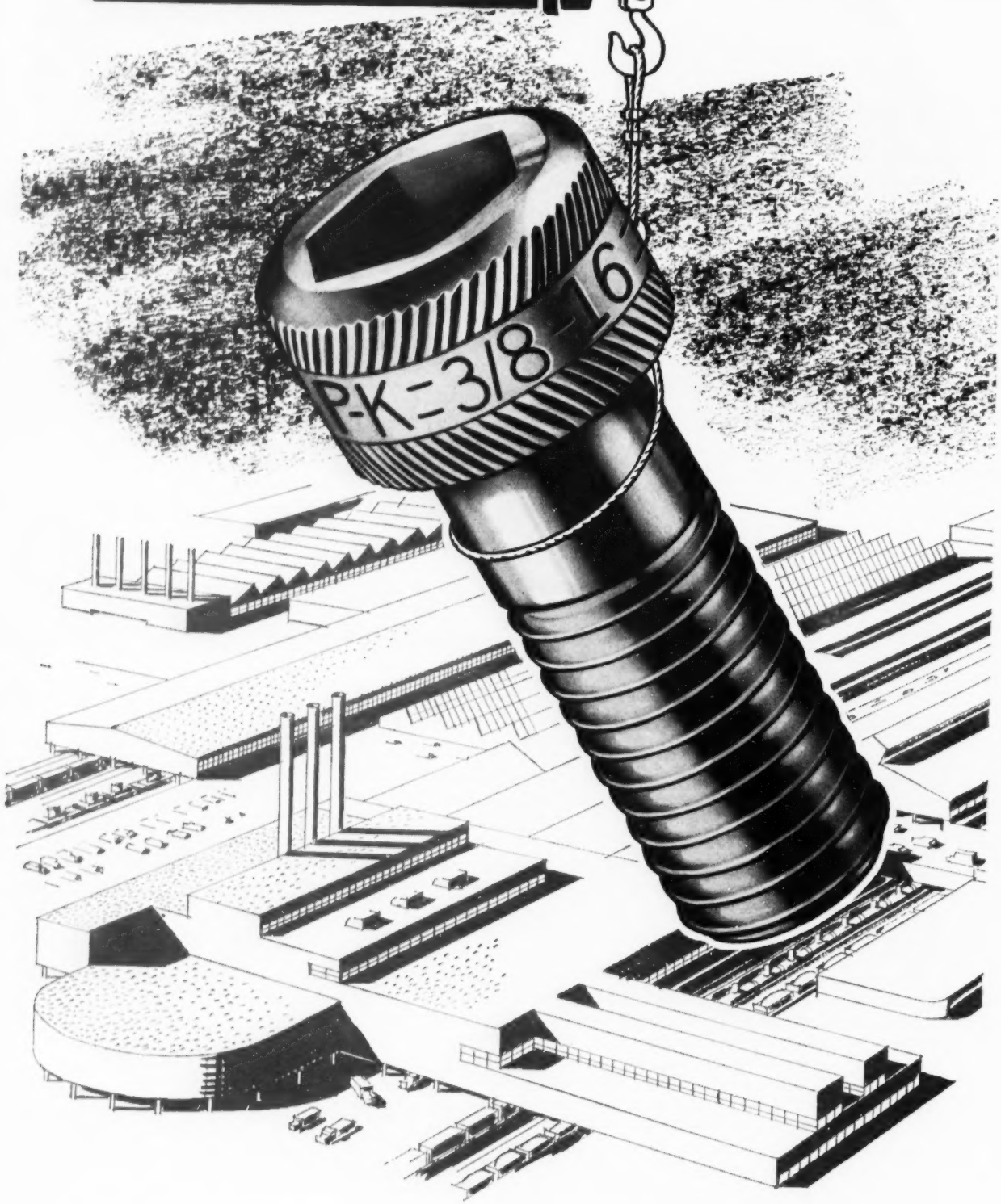
American Felt Company

TRADE MARK

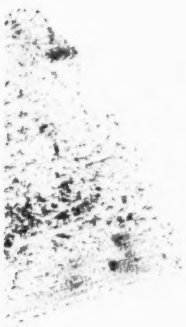
GENERAL OFFICES: 68 GLENVILLE ROAD, GLENVILLE, CONN. SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Dallas, San Francisco, Los Angeles, Portland, Seattle, San Diego, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.—ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

For more information on products advertised, use Inquiry Card, page 261

Delivering . . . the



fastener ideas of the future

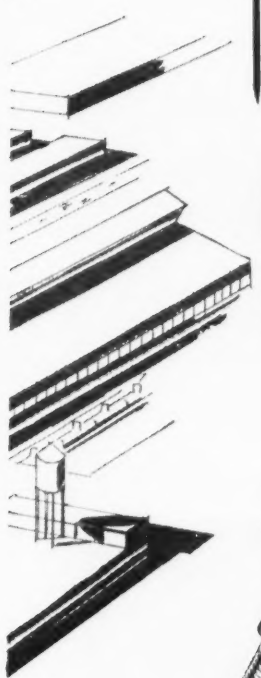


Back in 1942, the Size-Mark on Socket Cap Screws was considered a visionary idea, attainable only in the distant future, by most fastener authorities. Ground Threads on Socket Set Screws were thought another of such "dream" developments.

But Parker-Kalon licked the problems, *delivered* both improvements *within the year,* on P-K Socket Screws.

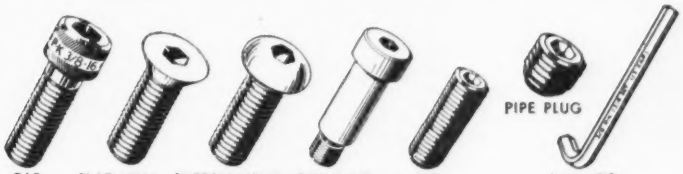
Originator of so many of the fasteners essential to modern assembly methods, Parker-Kalon has always preserved the pioneering spirit. You can continue to look to P-K for the fastener ideas of the future, *delivered today.*

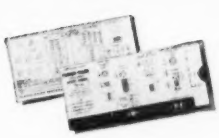
Get samples of P-K Socket Screws . . . and compare. See why they'll put your product a step ahead . . . assembly-wise and sales-wise.



PARKER-KALON®
SOCKET SCREWS

The *only* Size-marked Socket Cap Screws
The *first* Ground Thread Socket Set Screws





SOCKET SCREW DIMENSION FINDER
Helps you plan assemblies. Pocket size plastic slide chart gives essential dimensions of all types of P-K Socket Screws. For a free Dimension Finder, Socket Screw samples, or other data, see your P-K Distributor. Or write: Parker-Kalon Corporation, 202 Varick Street, New York 14.

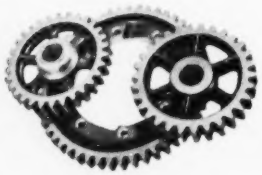
The INDUSTRIAL DISTRIBUTOR steers your supply dollars to the best values.

gears and gear assemblies

bevel gears for all industry

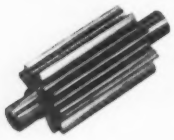
gears and gear assemblies for farm implements and tractors

make AMgears **your** gear department



for power shovels

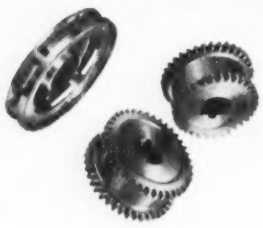
"Air Spec" gears



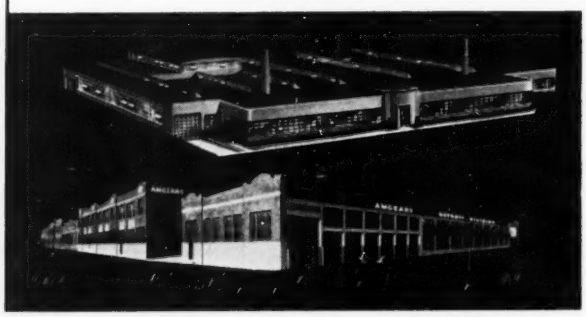
ground tooth pump gears for diesel engines

"Air Spec" worm gears

Internal gears for engines and transmissions



special gears and gear assemblies



AM ACCURATELY MADE gears, INC.
A SUBSIDIARY OF HUPP CORPORATION

CLEVELAND • DETROIT • CHICAGO

2 big plants for gears and gear assemblies with a customer list that reads like Who's Who in American Industry.

CHICAGO 6633 WEST 65TH STREET, CHICAGO 38
DETROIT 7450 MELVILLE, DETROIT 17

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60 tractor crankshafts per hour with

Avey 12 STATION LINE-O-DEX

12 Station Transfer Machine—Hydraulically operated indexing mechanism—operations include drilling all angular oil holes plus connecting metering holes. Machine incorporates all Avey-draulic Torque-matic Units for Deep Hole Drilling with Avey Cam Units and Drill Heads for Meter Hole Drilling. Machine conforms to J.I.C. Standards.

Write for details

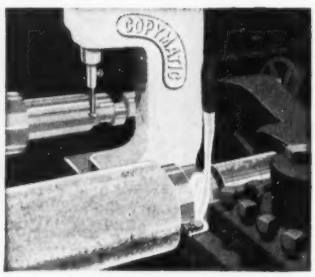
Avey

for drilling . . . tapping . . . production machines

THE AVEY DRILLING MACHINE CO.

Cincinnati 1, Ohio

HOW HIGH IS UP?



Perhaps it's "the point toward which manufacturing costs are constantly climbing." What methods may be used to keep costs and prices from vanishing out of sight and reason?

Since time and manpower are the vital elements in costs, many progressive manufacturers are using Lodge & Shipley COPYMATIC Tracer Controlled Lathes to combat rising costs. Carefully verified reports show time savings as high as 87%, production increases up to 536%, savings of $14,000 in a year.

The COPYMATIC is so versatile even smaller shops find it a profitable producer . . . it offers instant changeover from tracer control to engine lathe. A COPYMATIC can save you money, too. Ask for case histories and Bulletin No. 675.

THE **Lodge & Shipley** COMPANY

3055 COLERAIN AVE., CINCINNATI 25, OHIO

For more information on products advertised, use Inquiry Card, page 261

NEW! BAY STATE BZ SAF-T-CUT

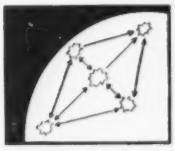
... A TRULY GREAT REINFORCED CUT-OFF WHEEL

REINFORCED CUT-OFF WHEEL
BZ SAF-T-CUT

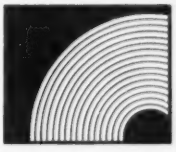
- GREATER SAFETY
- GREATER COOLNESS
- GREATER LIFE (10 TO 20%)
- GREATER STRENGTH (100%)
- GREATER CUTTING SPEED (UP 20%)
- GREATER RESISTANCE TO LOADING

ACTUAL TESTS PROVE THAT BZ SAF-T-CUT WHEELS ARE... STRONGER... FASTER... COOLER

Reinforced with tough glass fiber for rugged STRENGTH and LONG LIFE.



New "BZ" Bond holds abrasive particles exactly right for OPTIMUM CUTTING POWER.



New Spiral Grooved sides give COOLER, CLEANER CUTTING on the 14" to 20" dia. sizes.

Micro photo shows "air-cooling" groove design that adds NON-BURNING feature.

Development of the new "BZ" bond was aimed at improving safety, cutting rate, and wheel life for all cut-off work on steel bars, pipe, angle iron and other structural shapes, as well as ferrous and non-ferrous castings.

Actual tests show fast, clean cuts on these materials, plus performance records of 10 to 20% better life... and up to 20% faster cutting rate than the best competition.

BAY STATE says to its sales force and to you, "We believe this 'BZ' SAF-T-CUT wheel to be the best reinforced resinoid cut-off wheel on the market today, from every point of view". Ask for a demonstration.

BAY STATE ®

Available in Aluminum Oxide abrasive (for cutting metals), and Silicon Carbide abrasive (for cutting non-metallic materials).
Call in your BAY STATE REPRESENTATIVE for details, or write for size and specification data.

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass.

Branch Offices and Warehouses: Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All Principal Cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd. Brantford, Ont.

M-R-C has long been known for leadership in the field of Super-Precision Ball Bearings. With the opening of our Super-Precision factory in Falconer, N.Y., we are now manufacturing Instrument Bearings of Super-Precision Quality.

MARTIN-ROCKWELL CORPORATION, Executive Offices: Jamestown, N.Y.

For more information on products advertised, use Inquiry Card, page 261

Here's the tapping combination you asked for!

• TAPPING MACHINE
Foot or air operated for fastest operation with minimum effort. Built-in lubrication set-up for any tapping need.
• TAPPING HEAD
Five sizes of tapping attachments—or a wide range of fixed or adjustable multiple spindle tapping heads designed to your specifications—all interchangeable to meet different job requirements.
• WORK HOLDER
Engineered for fastest tapping and handling of the part.

Ettco-Emrick

"UNIT ENGINEERED" 72A TAPPING MACHINE

With this Ettco-Emrick tapping combination—a rigid, sensitive tapping machine—a built-for-the-purpose tapping head—and a custom-built work holder—you can do any tapping job faster, easier and more economically. Its low initial cost and accurate, high-speed work make it a worthwhile investment for any shop, whether for tapping a single hole or thirty holes.

Your local Ettco-Emrick distributor will be glad to give you full information on the amazingly versatile 72A tapping combination. He's in a position to give you sound, expert advice on the best set-up for your needs. Call him in today. If you'd like literature

WRITE FOR BULLETIN 72A

It contains a wealth of information and data on how to use the 72A Tapping Unit to solve specific tapping problems. It's yours for the asking.

Ettco-Emrick

ETTCO TOOL CO., INC.

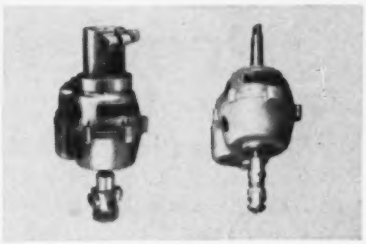
592 Johnson Ave., Brooklyn 37, N. Y.

DETROIT • CHICAGO • WORCESTER • SAN GABRIEL, CALIF.

Dealers throughout the United States and Canada

DRILLING and TAPPING EQUIPMENT NEWS

Tool Up Any Drill Press For Fast, Accurate Tapping

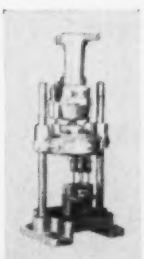


Ettco-Emrick tapping attachments can be mounted on any drill press. Newly patented friction clutch provides the delicate sensitivity needed for high speed tapping or threading. 7 different models for No. 6 to ⅝" dies and for No. 0 to 1" taps. *Details in Bulletin No. 22. Write Ettco Tool Co., 592 Johnson Ave., Brooklyn 37, N. Y.*

Balanced Tap Chuck Insures Greater Accuracy

Balanced construction of this newly designed precision-made Ettco-Emrick tap chuck eliminates "whipping" action and insures greater accuracy. Light weight and small external dimensions minimize spindle inertia on reversing, making it suitable for either light, sensitive work or heavy duty jobs. Sizes available with capacities ranging from No. 0 to 1" taps. *For details, write Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn 37, N. Y.*

Multiple Tapping and Drilling Heads Offer Big Savings



With Ettco-Emrick "Unit-Engineered" Multiple Heads, it is possible to tap or drill from 8 to 30 holes at one stroke on any drill press. Heads and work holders are engineered as a unit to meet shape and hole pattern of part being tapped and to insure fastest handling and tapping. Standardized stock parts keep initial costs low and allow heads to be converted from tapping to drilling or back again in a matter of minutes. *Details in Bulletin No. 3. Write Ettco Tool Co., 592 Johnson Ave., Bklyn. 37, N. Y.*

Surface Finish is

. . . when you buy a DoALL Precision Surface Grinder

WHEN you buy a DoALL Precision Surface Grinder, you receive a tag certifying the surface finish it will produce under normal shop conditions. No fancy lab tests, no special setups—just the routine inspection of the grinder as it comes off the assembly line. With the certification, you get the actual test block produced by your machine.

Every DoALL Surface Grinder is guaranteed to give you:

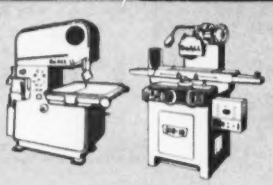
1. **Surface finish of 10 micro-inches RMS or better.** This is what any operator can get on your job. DoALL consistently produces 2 to 3 micro-inch finishes when grinding DoALL Gage Blocks prior to lapping.
2. **Flatness to .0002" over entire area of 108 sq. in. chuck.** This means flatness over any small area to within a few millionths of an inch.

You cannot buy a finer, more accurate surface grinder for production or toolroom use. Prove this to yourself by operating a DoALL Grinder at your plant. Simply call your local DoALL Store and ask for a free demonstration, or write:

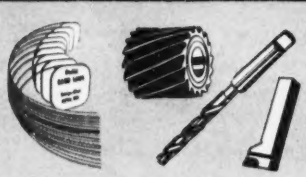
THE DoALL COMPANY, Des Plaines, Illinois

FREE WHEEL BALANCER
with every grinder!

Only a perfect balanced wheel will produce a fine finish. This DoALL Wheel Balancer is the answer—simple, rugged and accurate. You pay nothing extra for it!



MACHINE TOOLS



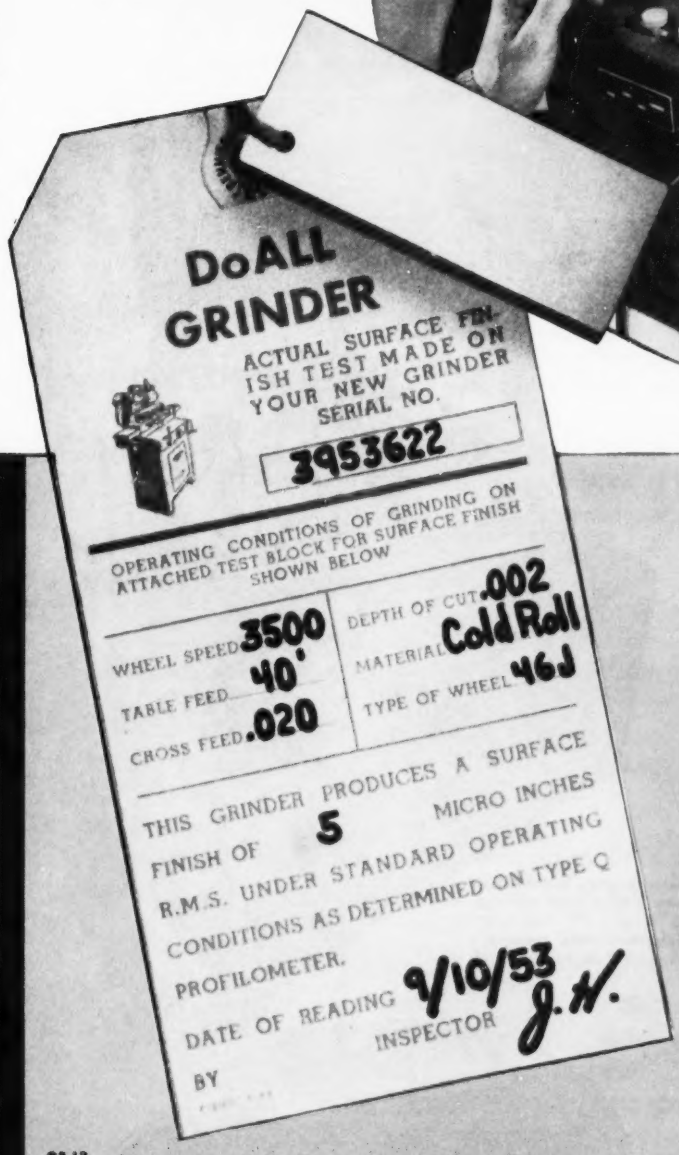
CUTTING TOOLS

GAGING EQUIPMENT

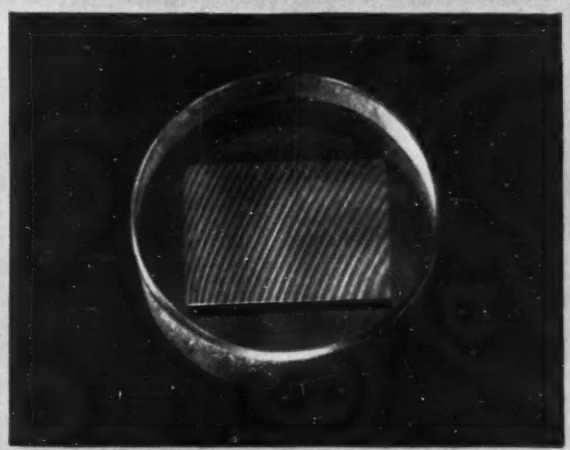
Certified

Right — Profilometer analysis of test block shows surface finish produced on new DoALL Grinder.

Below — The test block and a surface finish certification tag accompany each new machine.


DoALL
GRINDER
ACTUAL SURFACE FINISH TEST MADE ON YOUR NEW GRINDER SERIAL NO.
3953622
OPERATING CONDITIONS OF GRINDING ON ATTACHED TEST BLOCK FOR SURFACE FINISH SHOWN BELOW
WHEEL SPEED 3500
TABLE FEED 40'
CROSS FEED .020
DEPTH OF CUT .002
MATERIAL Cold Roll
TYPE OF WHEEL 46J
THIS GRINDER PRODUCES A SURFACE FINISH OF 5 MICRO INCHES R.M.S. UNDER STANDARD OPERATING CONDITIONS AS DETERMINED ON TYPE Q PROFILOMETER.
DATE OF READING 9/10/53
INSPECTOR J.H.
BY

GR-12



2 to 3 Micro-inch Surfaces Produced on Gage Blocks!

DoALL Grinders are actually capable of producing even finer finishes than those certified. Prior to final lapping, DoALL Blocks are ground to 2 to 3 micro-inch RMS surface finish on standard machines. Picture above shows block under optical flat. Surface was ground flat within 20 millionths.

METALWORKING SUPPLIES

DoALL

ASK FOR CATALOG . . . NO OBLIGATION.

New Idea . . .
IN TESTING CASTINGS FOR LEAKS

TURNER MACHINE PRESSURE TESTS AND ISOLATES THE LEAK AUTOMATICALLY!

Turner leak-testing machines are adaptable to almost any size or shape production casting!

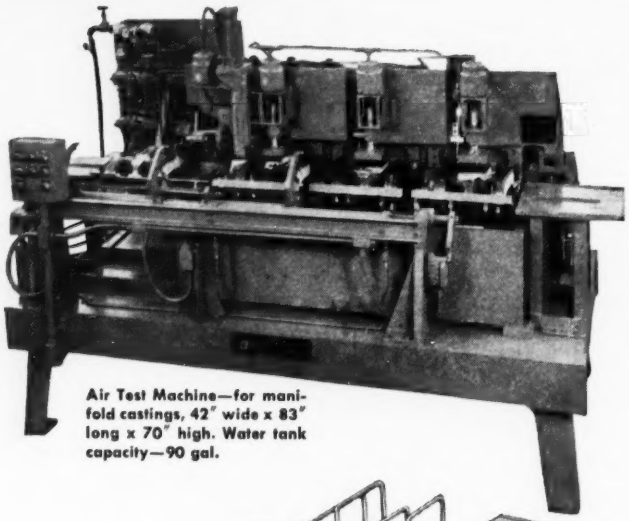
Fixture is specially designed to hold *your* casting, but base and all other parts are standard. That way manufacturing costs are kept at a minimum. You have all the advantages of a machine specially designed for your job, without paying for a special machine design!

Here are two typical applications:

1

Turner Air Test Machine

Designed to leak test manifold castings. Casting is picked up from the automation station, brought into loading position, then transferred automatically to each testing station. When casting is in position in the fixture, the machine clamps it securely in place and seals all openings. By means of air cylinders the casting is then dropped into a 90 gal. water tank and remains submerged for about 15 seconds—allowing the operator ample time to detect and mark any leak. As the checked casting is ejected onto the automation system, the transfer mechanism picks up another casting and the cycle is repeated.

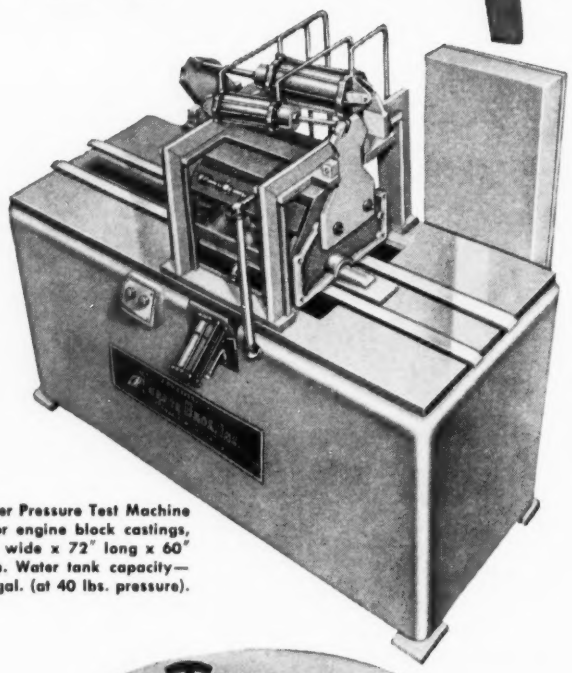


Air Test Machine—for manifold castings, 42" wide x 83" long x 70" high. Water tank capacity—90 gal.

2

Turner Water Pressure Test Machine

Designed to leak test 8-cylinder engine block castings. In this special Turner machine application, engine blocks are manually loaded, but automatically clamped and unclamped in the holding fixture. Water is introduced into the block at 40 lbs. pressure, a force strong enough to allow the operator to visually detect possible leaks anywhere in the casting. For high production, this Turner machine can be equipped with an automatic transfer loading and unloading mechanism.



Water Pressure Test Machine —for engine block castings, 40" wide x 72" long x 60" high. Water tank capacity—50 gal. (at 40 lbs. pressure).

• • •

If you have a production or inspection problem for which you can use to advantage a special purpose machine, write today describing your problem. After our engineering department analyzes it, our field engineer will discuss it with you.

• • •

TURNER BROS. INC.
2625 HILTON ROAD
FERNDALE 20, MICHIGAN

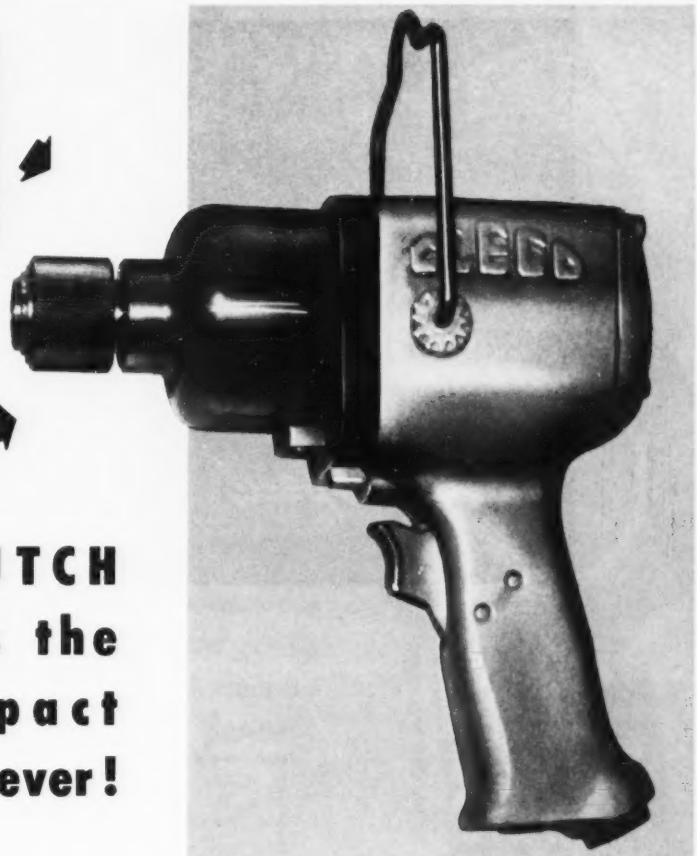
DESIGNERS and BUILDERS of:
- SPECIAL MACHINES
- JIGS and FIXTURES

TURNER BROTHERS

For more information on products advertised, use Inquiry Card, page 261

The new A3-SQ Reversible Impact Wrench with integral 7/16" hex. quick-change chuck for screw driving.

New shape of steel housing gives better view of work.



NEW STEEL CLUTCH HOUSING makes the CLECO A-3 Impact Wrench better than ever!

The Cleco A-3 reversible pneumatic impact wrench is a rugged production tool that features a powerful air motor and a patented impact mechanism that uses no springs or other fragile parts.

The steel clutch housing (available as optional equipment on the A-3 Impact Wrench) is also furnished with ½" square drive. Specify Model A-3S.

3" or 6" extended spindles are also available at no extra charge.

Ask your Cleco representative, or write us direct, for a demonstration in your plant.

SPECIFICATIONS A3-SQ WRENCH

Capacity	⅜" bolt or stud
Weight	5 lbs.
Over-all length	7⅛"
Spindle offset	⅞"

Bail furnished, if specified, at no extra cost.

CLECO AIR TOOLS

PNEUMATIC DALLETT ACCESSORIES

CLECO DIVISION

of the REED ROLLER BIT COMPANY, 5125 Clinton Drive, Houston 20, Texas, U. S. A.

AIR TOOLS FOR EVERY PURPOSE

- Grinders • Sanders • Rotary Drills • Riveters • Backfill Tampers
- Chippers • Scaling Tools • Impact Wrenches • Screwdrivers • Sump Pumps
- Paving Breakers • Spike Drivers • Air Line Accessories and Fittings

In Canada: Cleco Pneumatic Tool Company of Canada, Ltd., 927 Millwood Road, Toronto (Leaside), Ontario

4596

get a better job done

with

Mor-Speed

save time

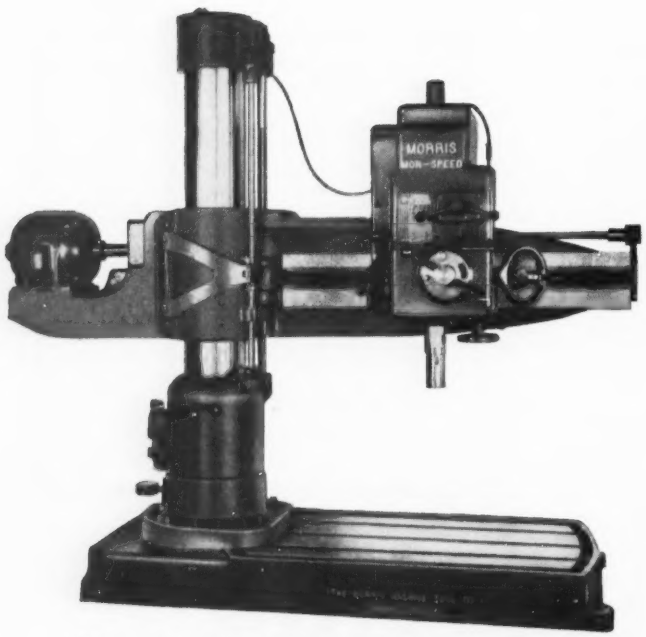
with completely centralized controls . . . instant selection of proper speed, feed; easily set automatic stops and trips.

with safety and dependability

tested safety devices safeguard machine, worker, workpiece . . . automatic lubrication protects built-in precision.

with lasting accuracy

alloy steels . . . modern hardening . . . extra anti-friction bearings, all assure minimum wear and low cost service.



9" Column Standard and Heavy Duty Models (with 3 and 4-foot arms)

11" Column Heavy Duty Model (with 3, 4, 5 and 6-foot arms)

Morris MOR-SPEED RADIALS

Whether for production or tooling MORRIS Mor-Speed RADIAL DRILLS give you fast, easy operation with accuracy so essential in holding down costs. Write for bulletin #59. Early deliveries available.

THE MORRIS MACHINE TOOL COMPANY

946 HARRIET ST. CINCINNATI 3, OHIO

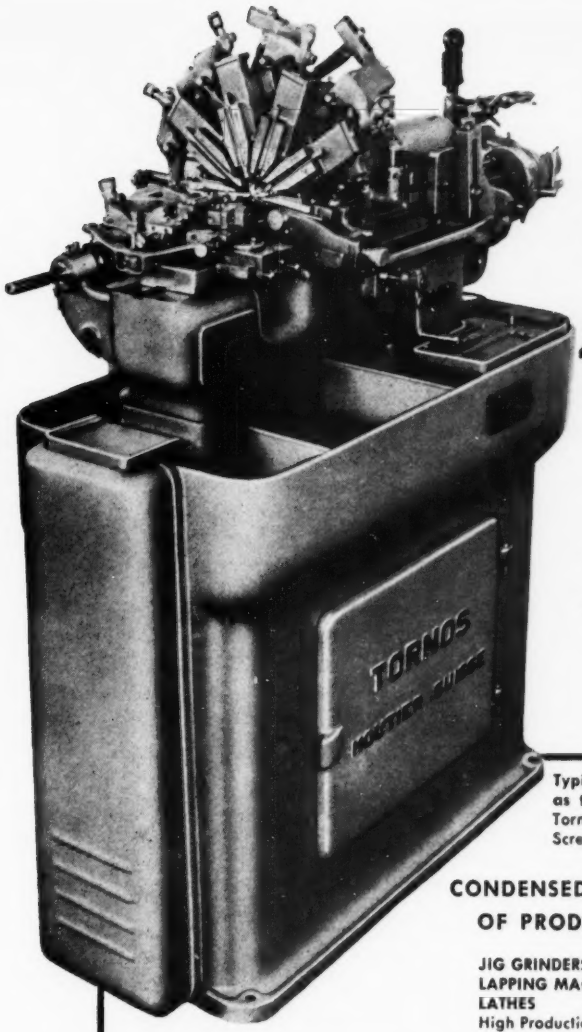
Morris

"A Better Product at Less Cost with PRECISION PLUS PRODUCTION."

For more information on products advertised, use Inquiry Card, page 261

SWISS BLUE RIBBON PRECISION MACHINE TOOLS

Backed right here in the U.S. by skilled technicians, factory service and guarantee, and spare parts readily available from every Hirschmann Branch.



Typical as to precision and as to fame of trade name. Tornos R10 Swiss Automatic Screw Machine.

CONDENSED SUMMARY OF PRODUCTS

BAND SAW & FILING MACHINES
CAM-MAKING EQUIPMENT
CHECKING & MEASURING INSTRUMENTS
Horizontal Micrometers • Optical
Vertical Micrometers
CHUCKS
Keyless Drill
DIAMOND & OTHER ABRASIVE WHEELS
DIE SETS
DIE SINKERS
DRILLING & TAPPING MACHINES
FINISHING MACHINES
Precision
FORMING & CUTTING-OFF MACHINES
Automatic
GEAR HOBBING MACHINES
GRINDERS
Tool • Twist Drill
GRINDING MACHINES
Hydraulic • Hydraulic Cylindrical
Jig • Optical • Universal
INDEX HEADS
Universal
JIG BORERS
JIG GRINDERS
LAPPING MACHINES
LATHES
High Production • Rapid Copying
Toolmakers' • Turret & Repitition
MILLING MACHINES
Cam • Production • Surface • Toolmakers'
PANTOGRAPHS
POLISHING MACHINES
PRESSES
Automatic for Bolt & Nut Industry
Bench • Cam • Die • Heavy Duty
Hot & Cold • Shaving
SCREW MACHINES
Swiss Automatic
SHAPER
Short Stroke • Copying
SPECIAL AUTOMATICS
For Watchmaking and similar industries
THREAD CHASING MACHINES
Semi-Automatic
THREAD CUTTING MACHINES
Automatic
THREAD ROLLING MACHINES
Automatic
TOOLS
Screw Machine-Carbide and High Speed Steel
TURNING MACHINES
Semi-Automatic

BLUE RIBBON List of Trade Names

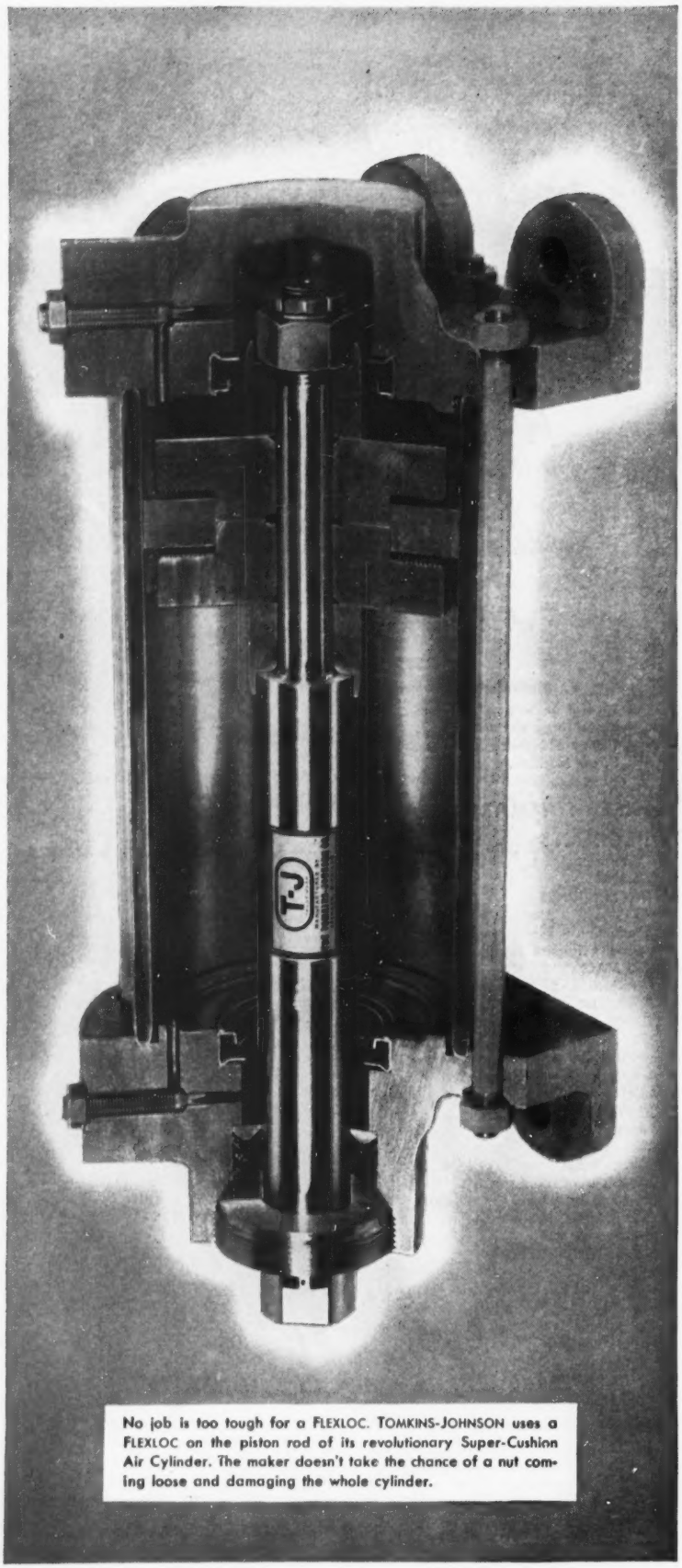
Agathon
Bartsch
Burri
Chappuis
Diametal
Dubied
Ebosa
Esco
Essa
Hauser
Hommel
Huller
Kellenberger
Kummer
Lambert
Lienhard
Manurhin
Meteor
Mipsa
Nassovia
Safag
Schaublin
Technica
Thommen
Tornos
Tripet

Exclusively Represented in the United States by Carl Hirschmann Co. 30 Park Ave., Manhasset, N.Y.

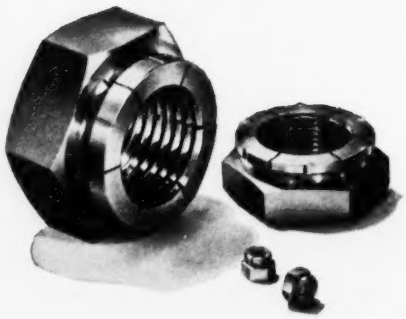
SWISS HIRSCHMANN

MANHASSET • CHICAGO • WATERBURY • DETROIT • LOS ANGELES • MILWAUKEE

Representatives in Principal Cities



No job is too tough for a FLEXLOC. TOMKINS-JOHNSON uses a FLEXLOC on the piston rod of its revolutionary Super-Cushion Air Cylinder. The maker doesn't take the chance of a nut coming loose and damaging the whole cylinder.



What FLEXLOC locknuts do for you

FLEXLOCs eliminate complicated, time-consuming methods of locking threaded fasteners. They offer simpler, faster application and safer, more dependable locking than plain nuts and lockwashers, castellated nuts and cotter pins, or nuts and jam nuts. And they won't work loose.

The reasons for all this are plain. FLEXLOCs are one piece—nothing to assemble, come apart, lose or forget. FLEXLOCs are all metal—have higher tensile than most other locknuts and are not affected by temperatures to 550°F. FLEXLOCs are both stop and locknuts—don't have to seat to lock, and stay put anywhere on a threaded member as soon as their locking threads are fully engaged.

SPS can deliver any quantity of FLEXLOCs in a wide range of sizes. Stocks are carried by industrial distributors everywhere. Write for literature. SPS, Jenkintown 19, Pa.

FLEXLOC

LOCKNUT DIVISION

SPS

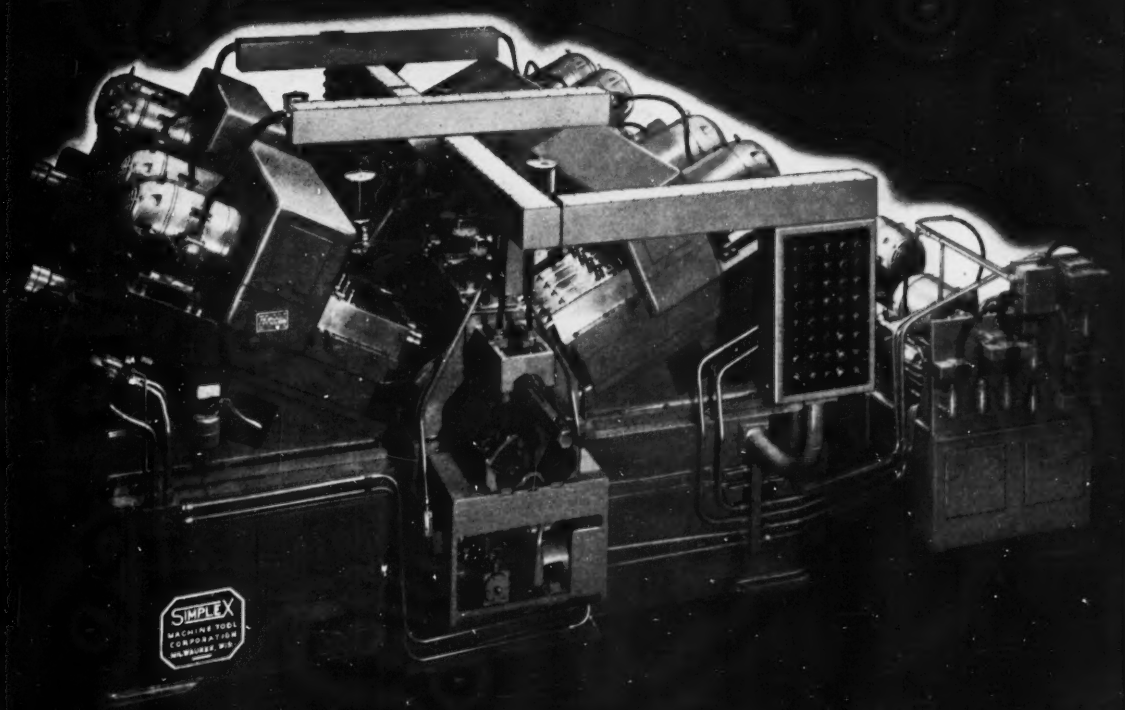
JENKINTOWN PENNSYLVANIA

Our Fiftieth Year : A START FOR THE FUTURE

For more information on products advertised, use Inquiry Card, page 261

Simplex

PRECISION BORING MACHINES



This seven station SIMPLEX Precision Boring Machine semi-finishes and finishes the tappet guide holes in V-8 cylinder block for one of the newest cars. It features precision performance, rugged reliability, master and unit push button control, simple and accessible construction for quick and easy inspection or service. J.I.C. standards, of course.

SIMPLEX MACHINE TOOL CORPORATION

4528 WEST MITCHELL STREET

MILWAUKEE, WISCONSIN

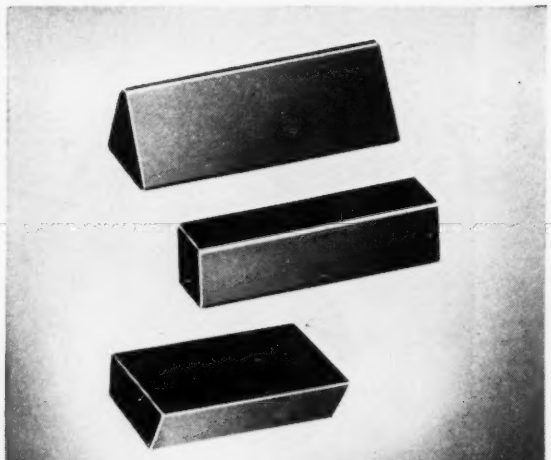
PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
SPECIAL DRILLING, TAPPING AND BORING MACHINES

A NEW CARBOLOY® CREATED-METAL

A heavy-duty carbide capable of cutting more cubic inches of steel per minute, with longer tool life, than existing carbides

. . . speeding your heavy-duty steel-cutting jobs up to 30 percent!

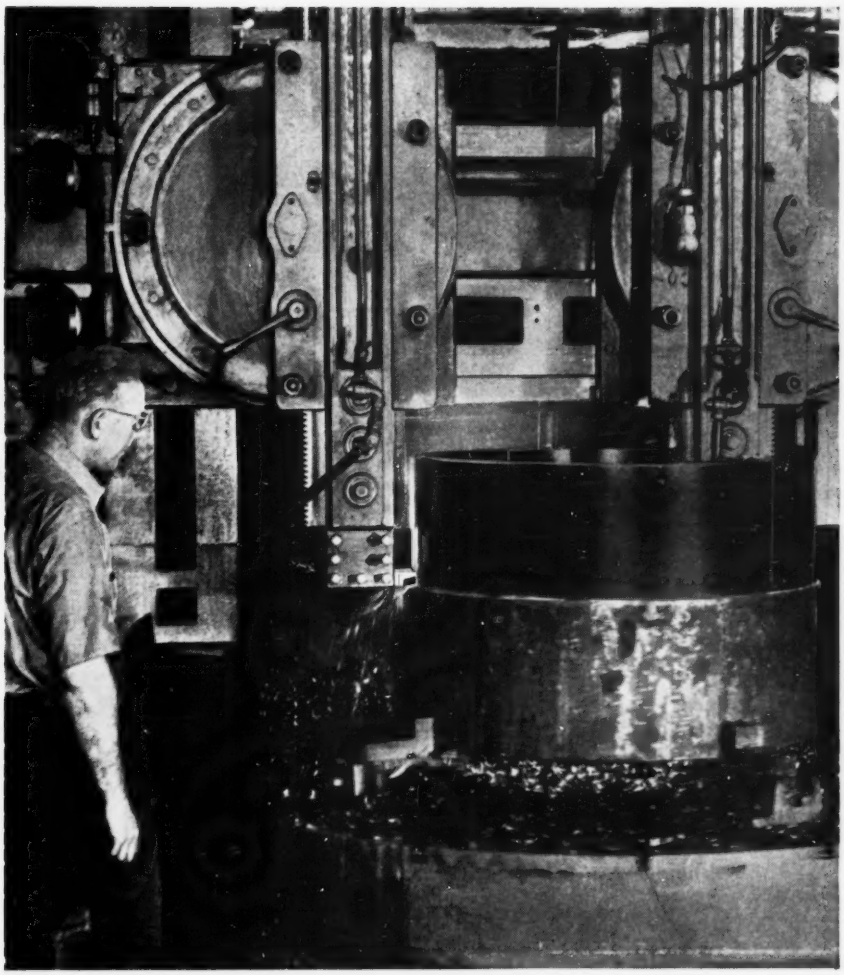
GRADE 370
The first of a new family
—Series 300—
of steel-cutting carbides



GRADE 370
CARBOLOY
CEMENTED CARBIDE

It's Grade 370 Carboloy Cemented Carbide – the first of an entirely new series specially developed for taking heavy cuts in steel at higher speeds. Unique grain structure lets it cut at around 1800° F without deforming – *higher than ever before practical* with any carbide. Tests and on-the-job applications indicate that Grade 370 can increase performance on many higher speed steel-cutting jobs by up to 30%. Now available in selected standard sizes and shapes.

"Carboloy" is the trademark for the products of Carboloy Department of General Electric Company



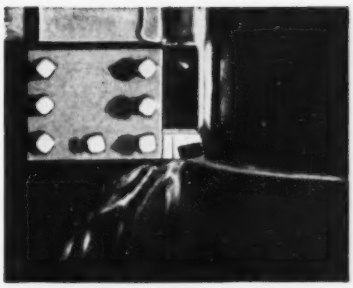
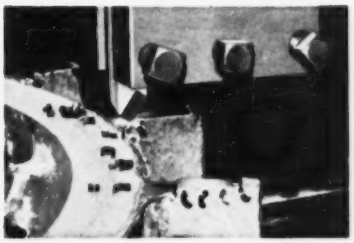


Photo at left and close-up, above, show Grade 370 taking a cut ½" deep, in large generator retaining ring of cast-alloy steel. The ring is machined at 110 FPM with .048" feed – causing tremendous heat to build up at the cutting edge. Grade 370 holds its shape and cutting edge under these tough conditions. Tool life increased 50%.



Above, Grade 370 machining generator stator frame. On this job a ½"-deep interrupted cut is made at a speed of 80 FPM with a .024" feed. Grade 370 continues to cut for longer periods under the constant jarring and high temperatures. Tool life increased 50%.

Grade 370 is the first of a new cemented carbide series tailor-made for today's *and tomorrow's* most severe metal-cutting conditions. The result of a quarter century of research- and development-pioneering in created-metals by the Carboloy Department.

MORE PERFORMANCE FOR YOUR DOLLAR

Its cutting superiority has been proved both in Carboloy laboratories and on tough on-the-job customer applications. On rolls, gun barrels, locomotive wheels and other heavy-duty operations, tools tipped with Grade 370 take heavier cuts at higher speeds and withstand higher temperatures than ever before practical – and this is done with even longer tool life than existing carbides. Tools cut more cubic inches of steel per minute . . . production goes up as much as 30%.

BUILT-IN TIP RIGIDITY

Exhaustive tests by Carboloy engineers showed that on heavy-duty, high-temperature machining applications where heavy pressure is encountered, other tools failed because the cutting edges deformed. Grade 370 is made from start to finish with a new, carefully controlled manufacturing process which gives it a built-in structural rigidity to resist this deformation – even at temperatures of around 1800° F.

AVAILABLE NOW

Grade 370 is available immediately in a number of sizes and shapes. Write today for additional information and for free technical literature. Carboloy Engineering Appraisal Service will work with you on specific applications.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

11147 E. 8 Mile Road, Detroit 32, Michigan

Gentlemen: Rush me, at no cost or obligation, all facts now available on your new Grade 370 Carboloy Cemented Carbide.

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

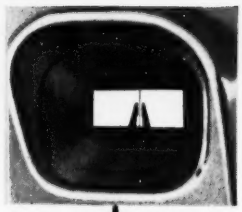
CITY_____ ZONE_____ STATE_____

For more information on products advertised, use Inquiry Card, page 261

Power... Speed... Precision...

SIP Jig Borers are today the key machines in every progressive works where accuracy and reliability are primary essentials.

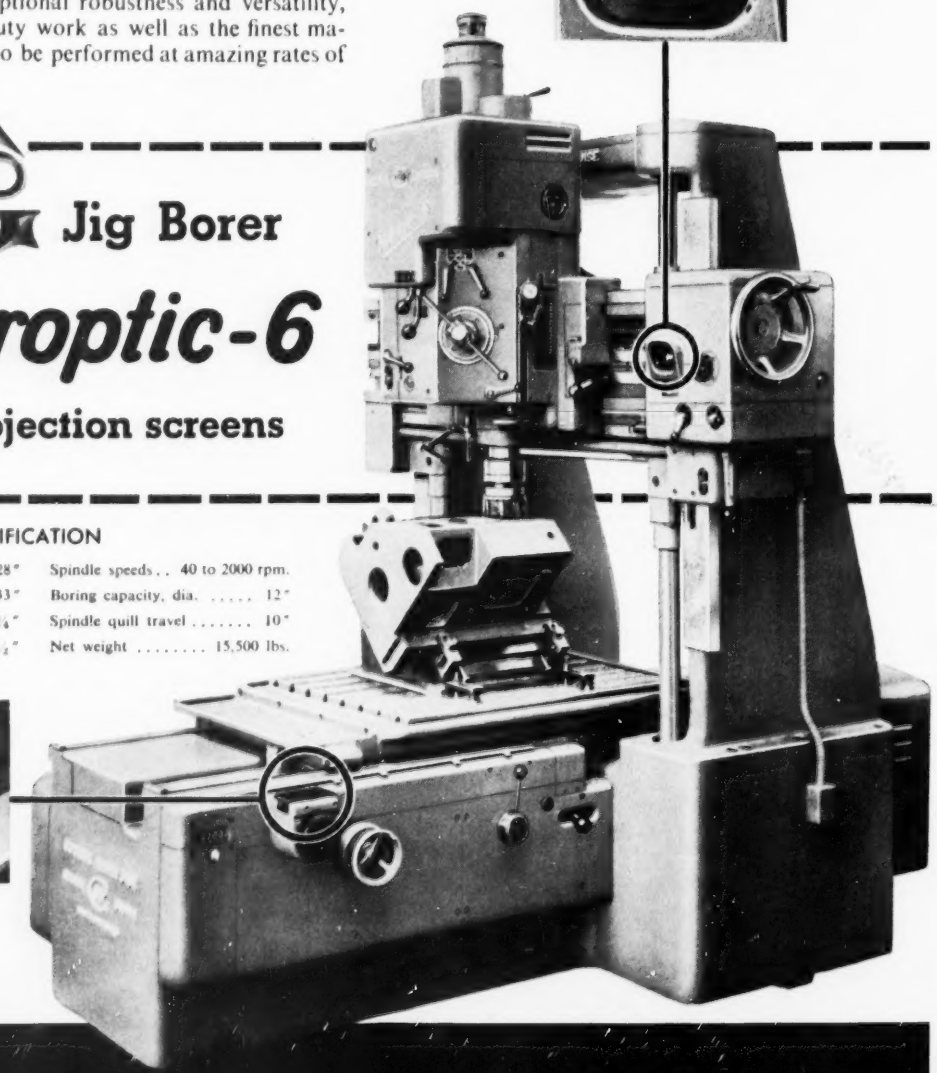
The SIP Hydroptic-6 Jig Boring and Milling Machine, of new design, is the last word in jig borer technique. It features an exceptional robustness and versatility, permitting heavy duty work as well as the finest machining operations to be performed at amazing rates of production.



SIP Jig Borer

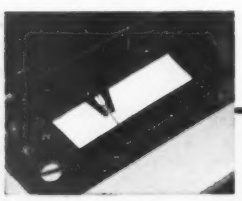
Hydroptic-6

with projection screens



SPECIFICATION

Working range	40" x 28"	Spindle speeds	40 to 2000 rpm.
Table surface	43 ¼" x 33"	Boring capacity, dia.	12"
Distance between uprights	43 ¼"	Spindle quill travel	10"
Table to spindle end	35 ½"	Net weight	15,500 lbs.



Guaranteed accuracy for all coordinate settings: .00015 in.

A17

This is one of the **standard scales**
which ensure the exceptional and permanent accuracy
of the coordinate settings of the

Hydroptic-6

A most valuable testimonial

Since more than 80 years, the Société Genevoise, Geneva, have supplied length standards to all prominent metrological institutes where they constitute the basis of all linear measurements.
Their unexcelled precision has been repeatedly acknowledged by the highest instances. The certificate illustrated at the right has been issued by the National Bureau of Standards, Washington. It relates to a SIP 40-inch standard scale the calibration of which showed that the total error of the division on the full length was only .00001 inch, a figure which requires no further comment.

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Certificate

for

40-inch Steel Bar

Maker: Société Genevoise d'Instruments de Physique.
Maker's No. 2550

Submitted by

Société Genevoise d'Instruments de Physique,
Geneva, Switzerland.

This bar has been compared with the standards of the United States, and a calibration has been made of the one-inch sub-intervals. The results obtained are as follows:

Length of the interval from the zero to the 40-inch line at 20° centigrade, with the bar supported at the points of Bessel:

40.00001 inches.

The observations were made at a mean temperature of 20.04° centigrade and in reducing to 20° centigrade, the coefficient of linear expansion of 0.0000115 per degree centigrade was used.

Calibration of Sub-intervals.
Length of sub-intervals at 20° centigrade.

Interval (inches)	Length (inches)	Interval (inches)	Length (inches)
(0 to 1)	1.00000	(0 to 21)	20.99996
(0 to 2)	2.00001	(0 to 22)	21.99997
(0 to 3)	3.00003	(0 to 23)	22.99997
(0 to 4)	4.00003	(0 to 24)	23.99997
(0 to 5)	5.00002	(0 to 25)	24.99998
(0 to 6)	6.00001	(0 to 26)	25.99996
(0 to 7)	6.99998	(0 to 27)	26.99998
(0 to 8)	8.00001	(0 to 28)	27.99997
(0 to 9)	8.99997	(0 to 29)	28.99998
(0 to 10)	9.99997	(0 to 30)	29.99997
(0 to 11)	10.99998	(0 to 31)	30.99997
(0 to 12)	11.99998	(0 to 32)	31.99996
(0 to 13)	12.99999	(0 to 33)	32.99998
(0 to 14)	14.00000	(0 to 34)	33.99999
(0 to 15)	14.99997	(0 to 35)	34.99999
(0 to 16)	15.99997	(0 to 36)	35.99998
(0 to 17)	16.99998	(0 to 37)	37.00000
(0 to 18)	17.99996	(0 to 38)	38.00002
(0 to 19)	18.99996	(0 to 39)	38.99998
(0 to 20)	19.99995	(0 to 40)	40.00001

Test No. 2.4/125714

Synonymous
with unexcelled accuracy

Total error of the division on the full length of 40 in. : .00001 in.

REPRESENTATIVE FOR U.S.A. AND CANADA:

AMERICAN SIP CORPORATION

HIGH PRECISION MACHINE TOOLS AND MEASURING EQUIPMENT
100 East 42nd Street NEW YORK 17, N.Y.

A17

"Buffalo"

Tips on Metal Bending

"Buffalo"

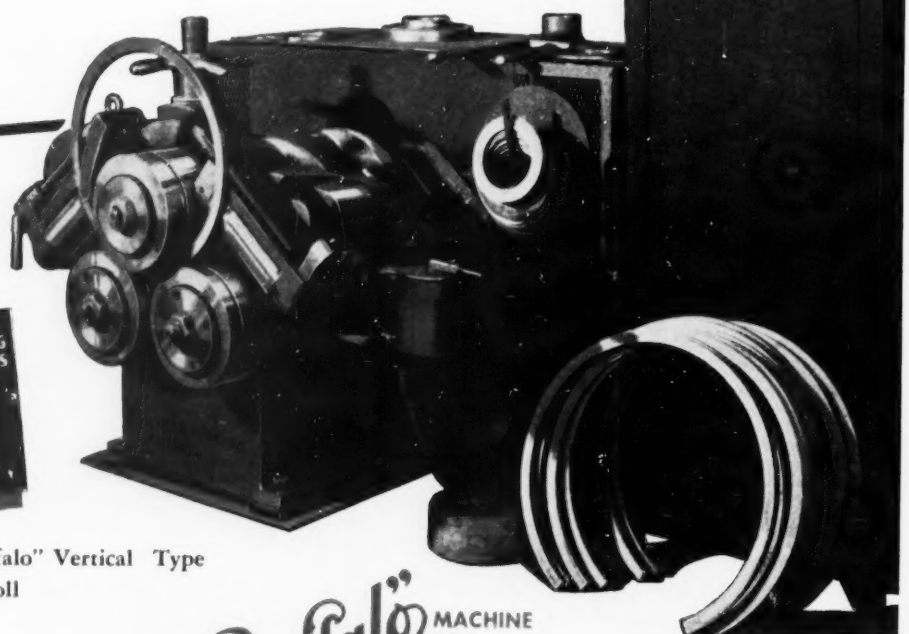
BENDING ROLLS CAN SAVE YOU MONEY!

PROBLEM: Bend commercially perfect circles, arcs or spirals at a profitable production speed from any of these standard sections:

1. Angles, leg-out
2. Angles, leg-in
3. Beams on flanges
4. Channels, flanges in or out
5. Flats on edge
6. Flats on flat
7. Rounds
8. Squares
9. Copper tubes
10. Standard St. pipe
11. X heavy pipe
12. XX heavy pipe

SOLUTION: Use a "Buffalo" Bending Roll. It handles all these jobs and more, faster and cheaper than any other method.

Why not write for Bulletins 3344-A and 352-B today?



"Buffalo" Vertical Type Bending Roll

"Buffalo" MACHINE TOOLS

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co, Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

For more information on products advertised, use Inquiry Card, page 261

Enough grease to bring an ordinary motor to a screeching halt

Greasing an ordinary motor is a matter of judgment. When too much lubricant is added to an ordinary motor bearing, grease is forced out of the bearing, along the shaft and into the windings. Then the inevitable happens. Winding insulation deteriorates, heat builds up and the motor burns out. Production stops . . . maintenance costs soar.

Life-Line* motors lick this problem with sealed, pre-lubricated bearings. Just the right amount of grease, specially compounded to resist oxidation or deterioration, is packed into each of these bearings at the factory. Then the bearing is completely sealed (not just shielded). You can't possibly over-grease a Life-Line motor because it never needs greasing.

Life-Line

The pre-lubricated bearing is one of the many features that make Life-Line motors the answer to lower operating and maintenance costs. REMEMBER: The way to grease a *modern* motor is DON'T!

*Trade Mark

YOU CAN BE SURE...IF IT'S

Westinghouse

J-21722

PHOTOMICROGRAPH OF TYPICAL INDUSTRIAL MOTOR GREASE MAGNIFIED 100X. COURTESY CASE INSTITUTE OF TECHNOLOGY

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVE DISCS
See Discs, Abrasive

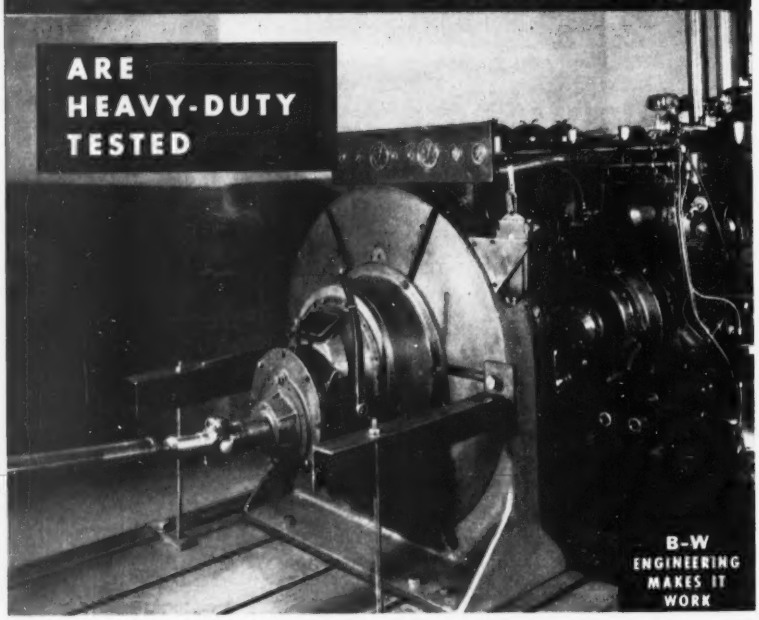
ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
DoAll Co 254 Laurel Ave., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

ROCKFORD CLUTCHES

ARE HEAVY-DUTY TESTED



Large ROCKFORD Clutches, Power Take-Offs and Speed Reducers are tested for torque, engaging pressure, release, temperature, gear strength, bearing endurance and clutch facing wear on this 400 H.P. diesel powered, electric dynamometer. Let ROCKFORD engineers utilize this machine to improve *your* heavy-duty power transmission controls.

B-W PRODUCTION MAKES IT AVAILABLE

ROCKFORD CLUTCH DIVISION BORG-WARNER
410 Catherine Street, Rockford, Illinois, U.S.A.

Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Aluminum
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

ALLOYS, Magnesium
Dow Chemical Co., Midland, Mich.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Havnes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page 366*)

For more information on products advertised, use Inquiry Card, page 261

Pressure Processing

. . . whoever uses it in their production is a customer or potential customer of **H-P-M**

Rugged Construction of CATERPILLAR Equipment Calls for Versatile, Dependable H-P-Ms!

Production men at Caterpillar Tractor Company find versatile H-P-M All-Hydraulic presses perform a wide variety of jobs in building Caterpillar's extensive line of tractors, engines, motor graders and rugged earth-moving equipment. There are 6 H-P-Ms in this diversified production line, ranging in size from 500 to 3500 tons . . . and, one press may do work on as many as 15 or 20 different parts.

If pressure processing plays a part in your production, it will pay you well to talk shop with an H-P-M engineer. Write today!

HPM

THE HYDRAULIC PRESS MFG. CO.

1042 Marion Road, Mount Gilead, Ohio, U. S. A.

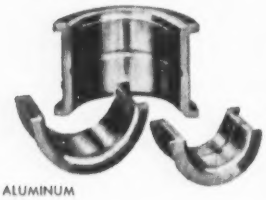
Presses for Every Pressure Processing Application

are you studying

ECONOMIES IN PRODUCTION?

then study **JOHNSON SLEEVE BEARINGS**

BABBITT ON STEEL OR BRONZE



ALUMINUM ON STEEL

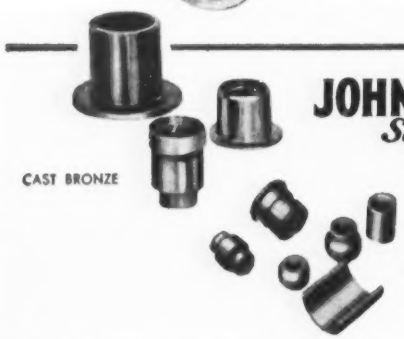
GRAPHITED

BRONZE ON STEEL

ALUMINUM ALLOY

THE sleeve bearing is much lower in original cost than any other type from which you may choose. In over 90% of your applications a Johnson Sleeve Bearing will give long, trouble-free service . . . in many instances, for the life of the product in which it is installed. It is quiet, corrosion resistant, conformable, and simple in construction. Possibly you are buying more bearing than you need. You can simplify and save with Johnson Sleeve Bearings. They are available in cast bronze, cast aluminum alloy, bronze-on-steel, aluminum-on-steel, babbitt on steel or bronze, molded powder metal, and graphited types. Johnson engineers will gladly consult with you on changing your designs to use economical Johnson Sleeve Bearings. Write for an appointment.

JOHNSON BRONZE COMPANY
520 South Mill St., New Castle, Pa.



CAST BRONZE

MOLDED POWDER METAL

JOHNSON JB BEARINGS
Sleeve-Type

SLEEVE BEARING HEADQUARTERS SINCE 1901

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson Jos. T. & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BALLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Kennametal, Inc., Latrobe, Pa.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

BARS, Phospher Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

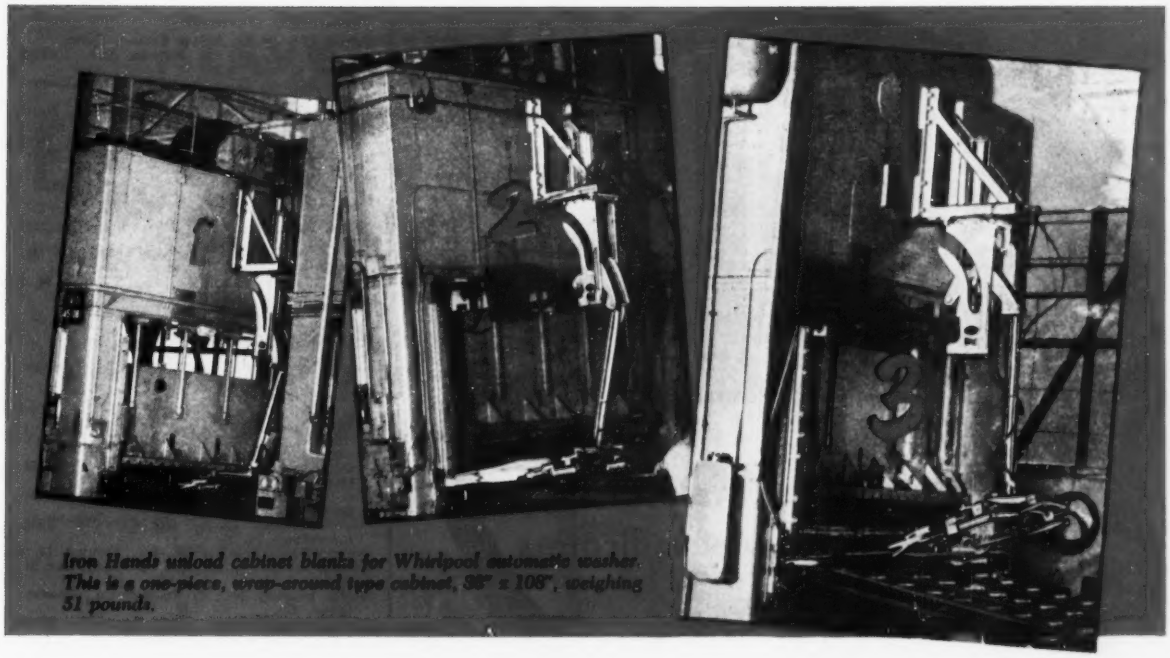
Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 5, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Torrington Co., Torrington, Conn.

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

(Continued on page 368)

For more information on products advertised, use Inquiry Card, page 261



Iron Hands unload cabinet blanks for Whirlpool automatic washer. This is a one-piece, wrap-around type cabinet, 38" x 108", weighing 51 pounds.

Whirlpool installs 3 Iron Hands!

Saves $20,000 annually... reduces accident hazard

Dependable operation of Iron Hands boosts production of automatic washers

Whirlpool Corporation recently installed Sahlin Iron Hands on three presses to automatically unload 51-lb. cabinet blanks for their automatic washers. By using the maximum press capacity for the first time, they obtained immediate increase in production—an increase, which according to Whirlpool officials, results in savings "in excess of $20,000 annually".

In addition to dollar savings, manpower requirements were reduced 40%. And the accident hazard was cut proportionately. Moreover, the three Iron Hands have given dependable service since their installation.

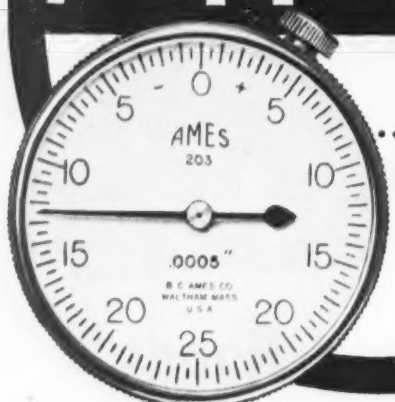
But Whirlpool's experience is no different from that of hundreds of others. Now, virtually every large stamping plant in the world uses these swinging arms to unload all types of press stampings—large and small. And they can be applied with equal efficiency to brakes, shears and forging machinery. The Iron Hand principle has also been adapted to floor-type extractors and to special feeding and unloading machines.

Join industry's swing to automation. Investigate the Sahlin Iron Hand. You'll find it can be equipped with a gripping jaw to handle practically any press stamping. Send for your free catalog today.

SAHLIN ENGINEERING COMPANY
267 Ferndale Street, Birmingham, Michigan
Representatives in: Cleveland • Dayton • Toledo
Pittsburgh • Philadelphia • Buffalo • Syracuse
Indianapolis • Los Angeles • San Francisco • Seattle
London • Paris • Milan

SAHLIN
IRON HAND
—to raise pressroom standards
SAHLIN
SWINGING ARMS (4 SIZES)
FLOOR TYPE—FIXED AND ROLL-AWAY MOUNTS • HORIZONTAL DESIGN • VARIOUS GRIPPING JAWS

AMES



...the preferred Dial Indicators

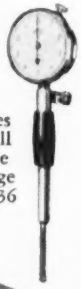
One of America's largest and most famous mass-producers recently chose Ames as preferred source of supply for indicator gauges.

The reasons behind this decision are the very reasons why *you* should standardize on Ames dial indicators and dial gauges:—the Ames "Hundred Series" indicators available in four sizes, fit every measuring requirement; they are *accurate, sensitive,* low in friction, yet are *rugged* and *tough*—give *more* on-the-job time. All Ames products embody latest design and highest-quality materials; they are manufactured by methods and machines that are *exclusive* with B. C. Ames Co.

Ames Dial Depth Gauge No. 11C

Ames Dial Micrometer No. 517

Ames Amplifying Dial Comparator No. 26



Ames Small Hole Gauge No. 36

Send today for your free copy of Catalog No. 58

Representatives in principal cities. B. C. AMES CO. *27 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Shafer Bearing Div., Chain Belt Co., Downers Grove, Ill.
S K F Industries, Ind., P. O. Box 6731, North Philadelphia, Pa.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle

C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Shafer Bearing Div., Chain Belt Co., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller

C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Orange Roller Bearing Co., Inc., Orange, N. J.
Shafer Bearing Div., Chain Belt Co., Downers Grove, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING TRANSMISSION

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

BENCHES, Work, and Bench Legs

Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.

Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
O'Neil-Irwin Mfg. Co., Lake City, Minn.

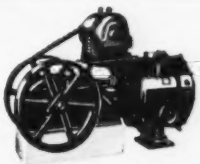
(*Continued on page* 370)

For more information on products advertised, use Inquiry Card, page 261

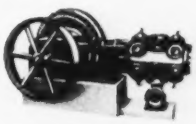
HEAVY-DUTY
"ES" COMPRESSORS

provide maximum efficiency in a
WIDE RANGE OF APPLICATIONS

. . . with unusual flexibility of drive and cylinder arrangements



OVERHEAD MOTOR

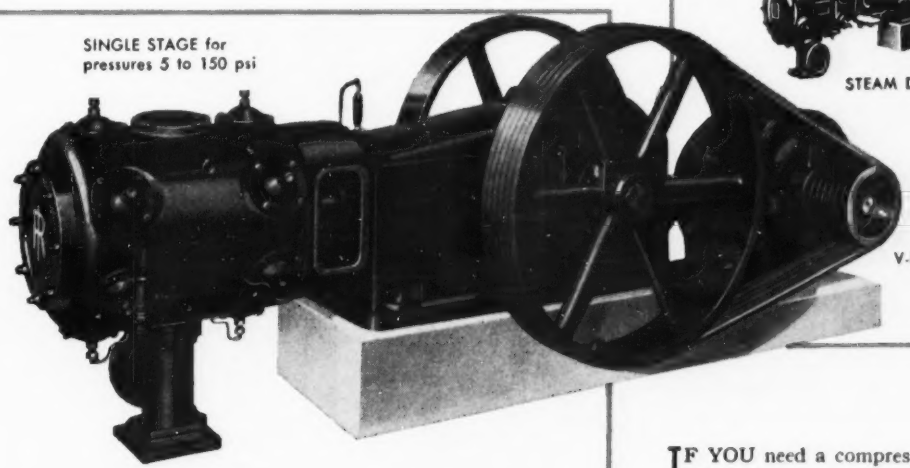


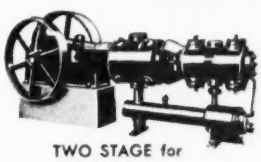
DIRECT-CONNECTED SYNCHRONOUS MOTOR

STEAM DRIVE

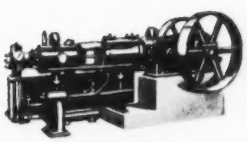
V-BELT DRIVE

SINGLE STAGE for pressures 5 to 150 psi

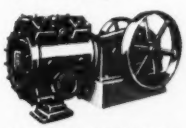




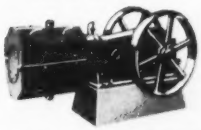
TWO STAGE for 150 to 500 psi



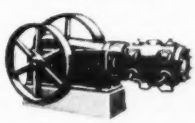
THREE STAGE for 500 to 2500 psi



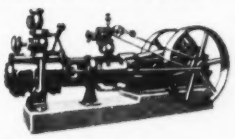
DRY VACUUM PUMPS . . . single or two stage



STEAM-PRESSURE BOOSTERS



NON-LUBRICATED CYLINDERS for oil-free air or gas



REFRIGERATION UNITS for ammonia or other refrigerants

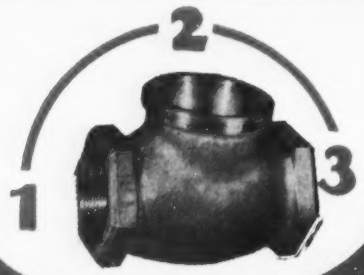
IF YOU need a compressor for any of the following purposes you should consider the Type "ES" compressor . . . a standardized, yet extremely flexible compressor built by Ingersoll-Rand, the pioneer compressor builder.

- To compress air or gas to any pressures between 5 and 2500 psi, or for pulling vacuums. (Stock cylinders are normally available for all frame sizes, see illustrations.)
- For capacities requiring from 5 to 125 horsepower. (Six frame sizes are available.)
- For continuous full-load operation day after day, week after week.
- For handling poisonous, inflammable, or other gases where leakage must be avoided.
- Where compressed air or gases must be free of all traces of oil. (Type NL cylinders require no oil, glycerine, grease or water for lubrication.)
- Where a future change in pressure conditions may call for a change in cylinder sizes.
- Where power cost is an important factor.
- To act as an economical standby unit for larger compressors whose full capacity is not required at all times.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. *Offices and Agents throughout the World* 859-1

COMPRESSORS • TURBO-BLOWERS • ROCK DRILLS • AIR TOOLS • CENTRIFUGAL PUMPS • CONDENSERS • OIL AND GAS ENGINES

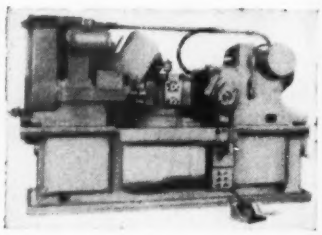


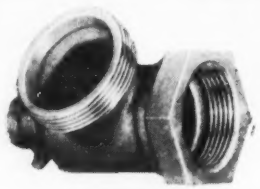
...and parts are finished without rehandling on

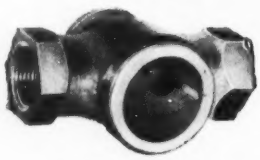
GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

The Goss & De Leeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & De Leeuw and only Goss & De Leeuw offers this feature in a standard chucking machine.







A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW — QUALITY PRODUCT-QUANTITY PRODUCTION

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A

BENDING MACHINES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Pines Engineering Co., Inc., Aurora, Ill. (Hydraulic)
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BLUING LAYOUT

Dykem Co., 2303 P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Loughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot

O. K. Tool Co., Milford, N. H.
Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.

(*Continued on page 372*)

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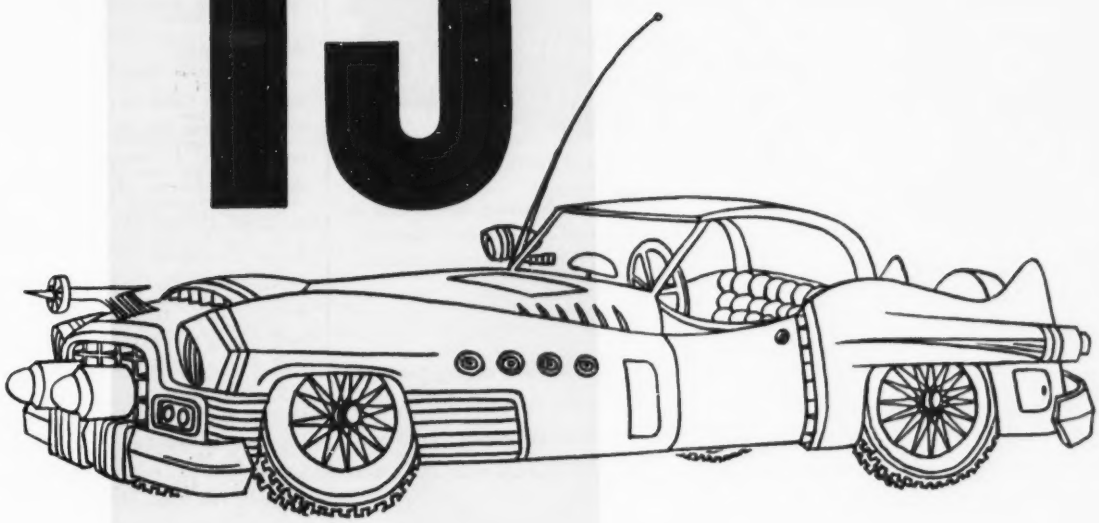

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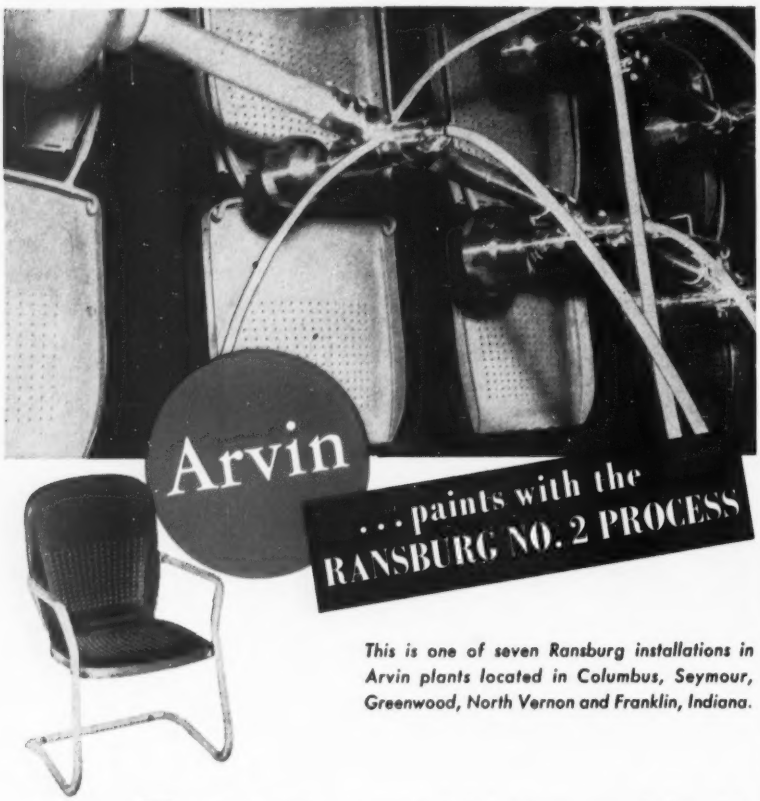
HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE • ACCUMULATORS • ALLEVIATORS • INTENSIFIERS



This is one of seven Ransburg installations in Arvin plants located in Columbus, Seymour, Greenwood, North Vernon and Franklin, Indiana.

When Arvin chair seats and chair backs were redesigned to be perforated with hundreds of little holes in each piece, the former dipping method of coating was unsatisfactory. Here are other reasons why RANSBURG NO. 2 PROCESS was selected to do the finishing job:

1. **Simplicity and rapidity with which colors may be changed without slowing production.**
2. **Less floor space required.**
3. **Provides improved quality with no variance in the required 7/10 mil film thickness.**
4. **Former maintenance and clean-up time reduced to a minimum.**

No savings in paint cost were anticipated. However, the RANSBURG NO. 2 PROCESS—in providing the above, desirable advantages—still enables Arvin to reduce finishing costs 10%. And, that over dip coat!

Want to know more about production efficiency of the NO. 2 PROCESS as it applies to YOUR production? Write for literature showing a variety of typical production installations in factories all over the country.

RANSBURG

Ransburg ELECTRO-COATING CORP.

INDIANAPOLIS 7, INDIANA

Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING AND TURNING MILLS, Vertical

American Steel Foundries King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Portage Mch. Co., Sweitzer Ave., Akron 11, O.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Maxwell Co., 420 Broadway, Bedford, Ohio.

(*Continued on page 374*)

For more information on products advertised, use Inquiry Card, page 261

Why you can *lower inspection costs*

with a Kodak Conju-Gage Gear Checker

Why the composite check

The composite check recommended in American Standard B6.11-1951 tests gears functionally by running the gear against a master of known accuracy. The resulting displacement shows at once the cumulative effect of as many as six types of error—eliminates time-consuming checks for each individual error. The check is rapid and conclusive.

Why the Kodak Conju-Gage Gear Checker

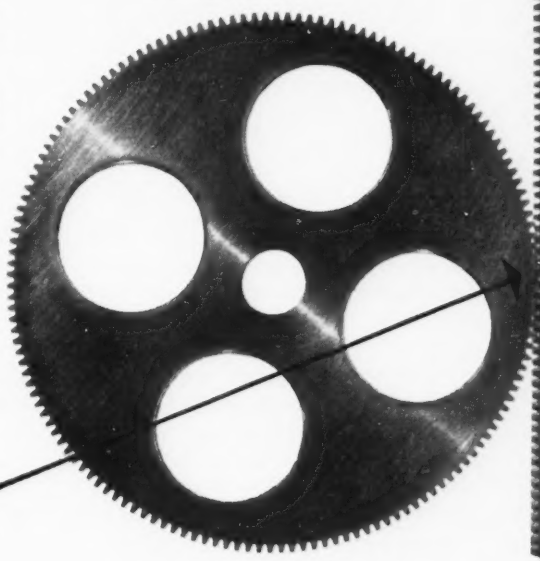
To meet today's tolerance requirements, the Kodak Conju-Gage Gear Checker uses a master made with a new order of precision. This is the Kodak Conju-Gage Worm Section, produced by thread grinding under control of a precision lead screw.

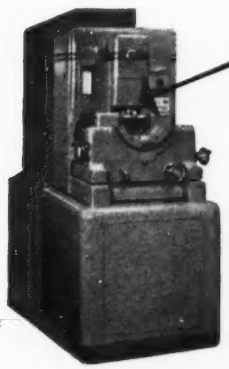
The accuracy inherent in this method means every right gear is passed by the worm section, reducing rejection losses. The transverse curvature produced by this method provides a master that can be used to check any gear of like pitch and pressure angle, regardless of helix.

Not only can a single worm section be used in place of a number of circular masters, but such a worm section can be reground to specification as often as necessary—at a fraction of replacement cost. It is easily checked for accuracy by familiar toolroom procedures.

You can find out more about the economies possible through Kodak Conju-Gage Instrumentation by sending for a copy of the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to:

Special Products Sales Division
EASTMAN KODAK COMPANY
Rochester 4, N. Y.





The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4⅛" pitch diameter. Larger and smaller models are also available.

CONJU-GAGE INSTRUMENTATION

... a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

Kodak

HOW B. Jahn

PROGRESSIVE DIES SLASH ARCTIC BUCKLE COSTS!

Intricate dies by B. Jahn actually form and assemble 140 buckles—complete with "snap" —per minute!

The production of low cost arctic buckles represents another difficult — seemingly impossible — tooling bottleneck solved by B. Jahn design and engineering ingenuity. Not only was forming required, but permanent assembly as well — complete with spring clip locking feature incorporated into finished assembly.

DIE RIBBONS ILLUSTRATING DIRECTION OF FEED AND COMPLICATED TOOLING REQUIRED. 9 STATIONS ON EACH SIDE OF THIS PROGRESSIVE DIE TERMINATED IN A CUT-OFF AND ASSEMBLY STROKE.

The inevitable result — a progressive die — production proved by B. Jahn to deliver 6720 finished buckles per hour — all identical — each ready for assembly line use.

To guarantee the die's performance in customer's equipment to his complete satisfaction, more than 25,000 buckles were submitted for gauging and assembly line use before the die was certified "Production Proved" and shipped. Not only arctic buckles, but countless components from typewriter keys to carbine clips, cameras to loudspeakers can be mass produced IN LESS TIME, AT LESS COST, TO FINER FINISHES WITH B. JAHN PROGRESSIVE DIES.

SEND NOW FOR FACTUAL, PICTORIAL BROCHURE— "The Story of B. Jahn Production Proved Dies".

B. Jahn

THE B. JAHN MANUFACTURING COMPANY • NEW BRITAIN, CONNECTICUT

McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Mummert-Dixon Co., Hanover, Pa.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.

BORING TOOLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BRAKES, Press and Bending

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

(*Continued on page 376*)

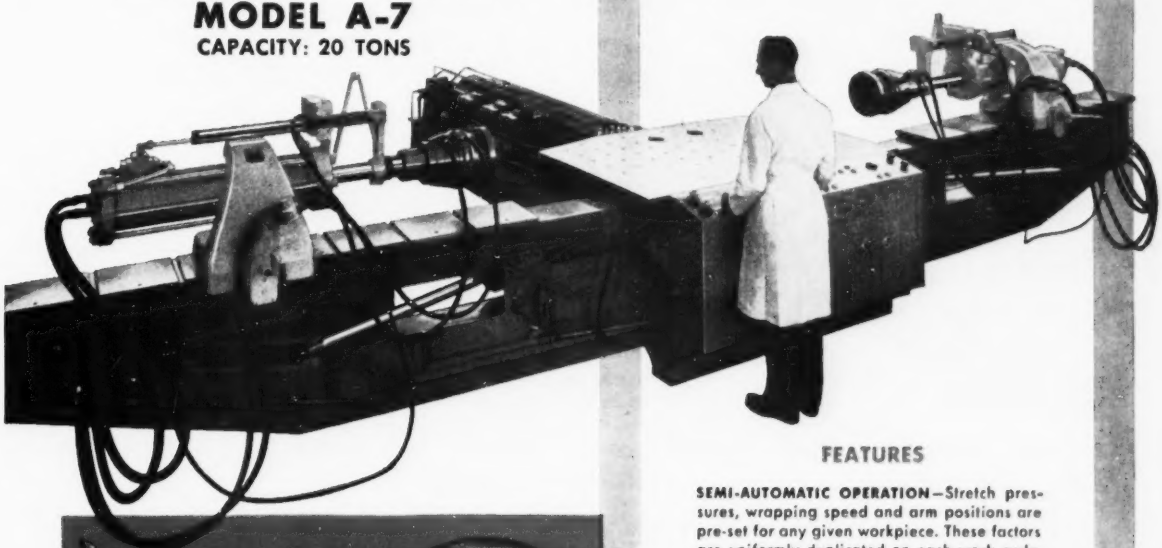
New up-to-date machine for high production stretch-wrap forming!

HUFFORD

MODEL A-7

CAPACITY: 20 TONS

Incorporating the latest engineering developments, this new Model A-7 Hufford provides *semi-automatic* operation in a low tonnage machine. It insures considerably higher output than older, manual models of a similar tonnage range and offers, in addition, increased forming versatility with *independent* arm actuation.



Put the Model A-7 to work forming parts like these!

FEATURES

SEMI-AUTOMATIC OPERATION—Stretch pressures, wrapping speed and arm positions are pre-set for any given workpiece. These factors are uniformly duplicated on each work cycle.

GREATER UNIFORMITY OF PARTS—with semi-automatic operation all human variations, normally affecting part uniformity, are eliminated.

NO SPECIAL OPERATING SKILL—Once machine functions are properly established, no special skill is required to produce excellent parts.

FEWER LOSSES—Work breakage from over-stretching is virtually eliminated on production runs.

INDEPENDENT ARM ACTUATION—Each arm is under independent control, simplifying setups on non-symmetrical dies and adding to forming versatility.

The Model A-7 is the ideal machine for modernizing your stretch-press department. Write for quotation!

HUFFORD
Machine Works Inc.
EL SEGUNDO, CALIFORNIA

Manufacturers of

Light where you need it — and in a jiffy!

LUFKIN

MITI-MITE Magnetic Base Portable "Handi-Lites"

STANDARD NO. 200
Up to 40 watt bulbs

HEAVY DUTY NO. 250
Up to 100 watt bulbs

Above, below, inside, outside — on tools, machinery, and work — the Handi-Lite has hundreds of uses in every shop. Permanent magnetic base attaches instantly to any ferrous surface, round or flat. Double swivel arms and reflector spot the light exactly where you need it.

Where do you need light? A Handi-Lite will provide it there — and in dozens of other spots in a jiffy.

Ask your distributor for a demonstration or mail the coupon for more information today.

BUY LUFKIN TAPES • RULES • PRECISION TOOLS From Your Distributor

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THE LUFKIN RULE CO., SAGINAW, MICHIGAN
132-138 Lafayette St., New York City • Barrie, Ontario

Send Today for FREE Illustrated MITI-MITE BOOKLET

THE LUFKIN RULE CO., Dept. M., Saginaw, Mich.
Please send me your free Miti-Mite booklet describing Handi-Lites.

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City_____ State_____

BROACHES
American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Detroit Broach Co., 20201 Sherwood Ave., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE
American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Johnson Bronze Co., New Castle, Pa.

BRUSHES, Industrial, Wire Wheel, Etc.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

BULLDOZERS
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BURS
See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.
Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.

(*Continued on page 378*)

For more information on products advertised, use Inquiry Card, page 261

UNIVERSAL "KWIK-SWITCH" TOOL HOLDER PERMITS TOOL CHANGES IN *10 SECONDS!*

Universal "Kwik-Switch" Tool Holders permit rapid tool changes for operations such as drilling, reaming, and boring on mills, radial drills, while maintaining accuracy and rigidity. Each tool is inserted in its Adapter Chuck and set to proper length and tightened. The Adapter Chuck is then easily locked or unlocked by hand in the Master Chuck by less than a quarter turn. Made of hardened and ground steel, and precision manufactured throughout. Available in straight and taper shanks to fit all machine tools. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis. — or our home office.

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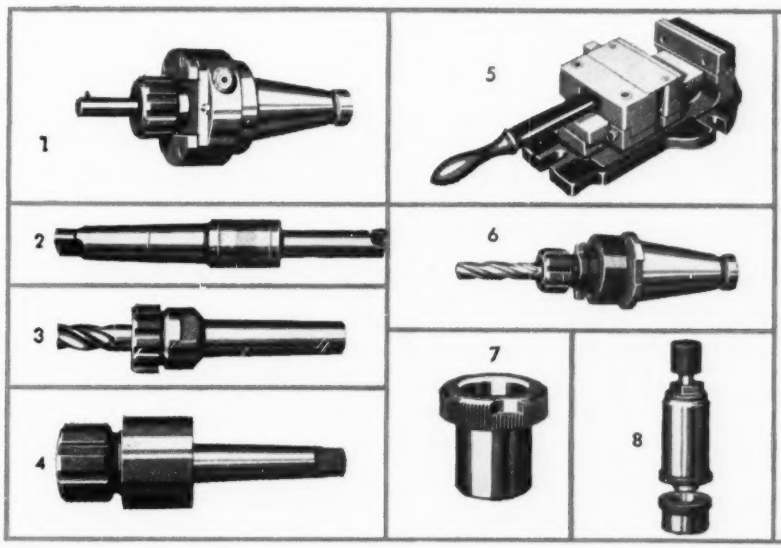
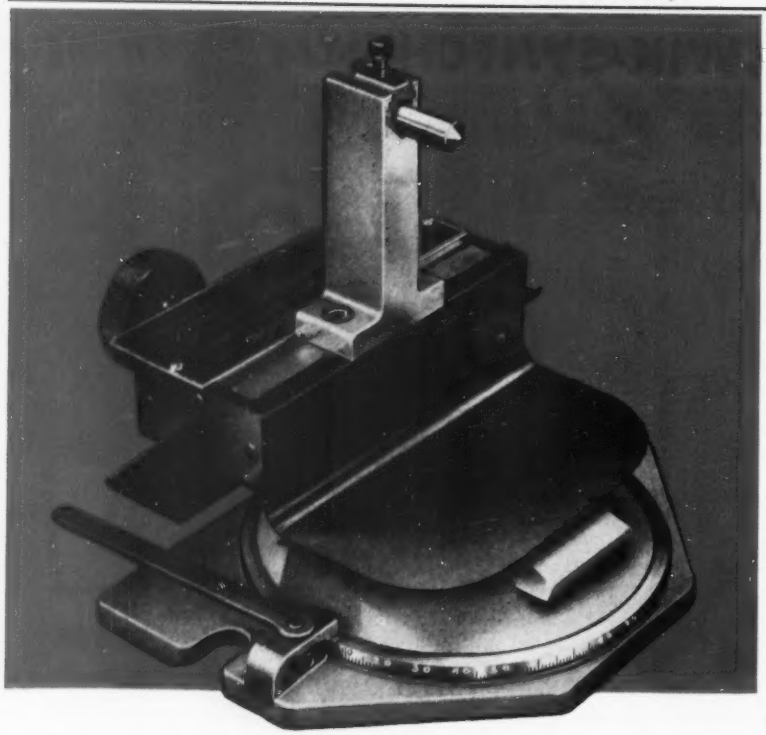


UNIVERSAL ENGINEERING COMPANY

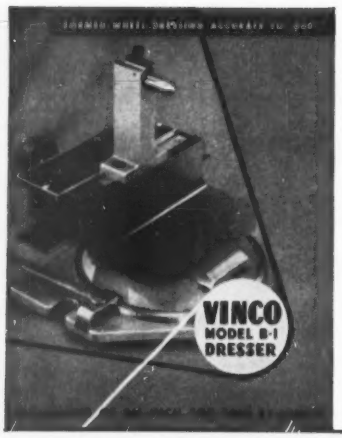
FRANKENMUTH 2 MICHIGAN

(1) BORING CHUCK
(2) MIKRO-LOK BORING BAR
(3) STANDARD COLLET CHUCK
(4) FLOATING COLLET CHUCK
(5) WEDGE-LOCK PRODUCTION VISE
(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER



Dress formed grinding wheels to a .0001" accuracy with the

B-1 Angle tangent to radius DRESSER



This easily operated formed wheel dresser is of sturdy construction and has exceptional built-in accuracy. Simple or complex forms can be dressed on grinding wheels to an accuracy of .0001". Years of use in thousands of plants have proved the worth of the Vinco Model B-1 dresser on production work as well as tool room and gage grinding operations.

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FREE! Send for this fully illustrated folder today. It's full of operating information and details concerning the famous B-1 dresser.

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Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kux Mch. Co., 3930-44 W. Harrison St., Chicago, Ill.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

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CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

CASTINGS, Die

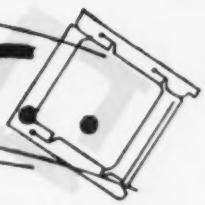
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Iron

Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Hansell-Elcock Co., 485 W. 23rd Place, Chicago 16, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

(*Continued on page 380*)

200 frames a minute.



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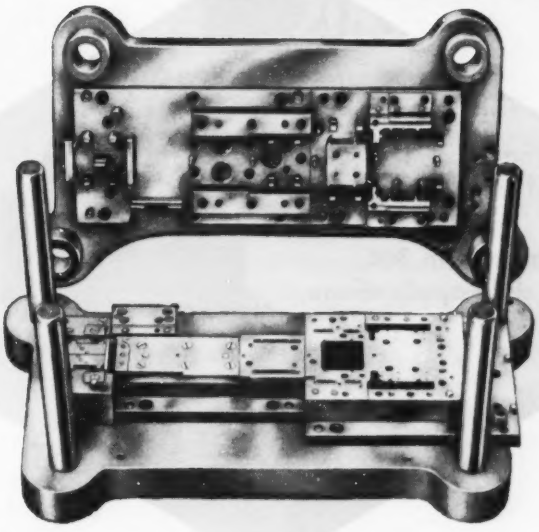

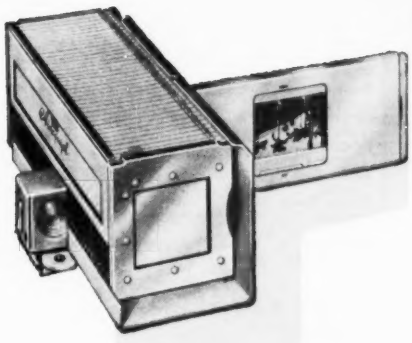

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12,000 pieces produced per hour
Over 2 million pieces produced between grinds
Continuous operation for 20 months

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Die: six-station (piercing, forming, cut-off)
Die Set: Producto special four-pin
Feed: special high-speed automatic

SPECIFICATIONS

Frame Size: 2.157 inches by 2.020 inches
Tolerances: plus .000 inch minus .005 inch
Material: .010 inch thick 52 S-H38 aluminum

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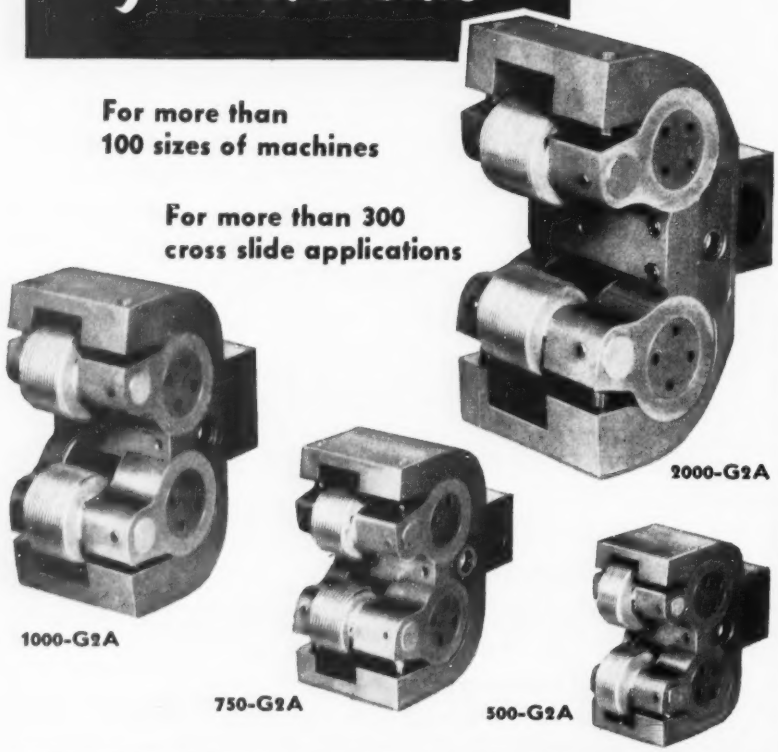

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CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe

Adams Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Thor Power Tool Co., Aurora, Ill.

CHUCKING MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Multiple Spindle), 170 E. 131st St., Cleveland, Ohio
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

(*Continued on page* 382)

Give Your Ejection Problems the Air

...and boost production and safety

1 End slow, dangerous hand removal of work with a Schrader Air Ejection Set. Install Schrader Air Ejection Sets on your power presses—or any machines with moving parts to actuate a cam or sliding tripper. You'll find production soars—up to 100% . . . operator safety is boosted 50%. Replace hand removal with Schrader Air Ejection and watch your presses take a new lease on life.

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Schrader Air Ejection Sets are delivered fully assembled and ready to go to work. Their low cost is more than repaid in just a few weeks.

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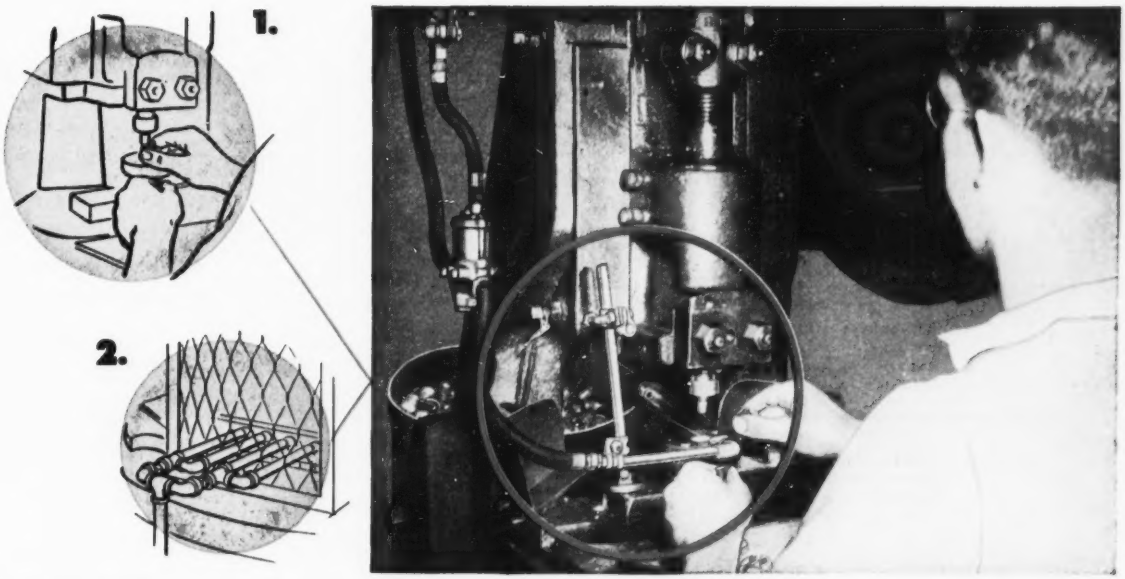

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SIMPLY PEEL FOR ADJUSTMENT

Shims stamped from brass or steel LAMINUM® *look and act like solid metal but they peel off in .002" (or .003") layers.*

Provide great accuracy yet allow easy machining tolerances

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Speed production by simplifying your spacing adjustments

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Reduce lathe time; no standby machine required during assembly

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Precision cut to your exact specifications, with careful quality control

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CUSTOM SHIMS STAMPINGS SHIM STOCK

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill

Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton, E., & Son Co., Windsor Locks, Conn.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Lathes, Etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Horton, E., & Son Co., Windsor Locks, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

(*Continued on page* 384)

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with the 3/4 to 3 HP RELIANCE V•S DRIVE Jr.

STYLE E

The All-Electric Adjustable-Speed Drive that eliminates mechanical gearboxes, clutches and variable-pitch cone pulleys

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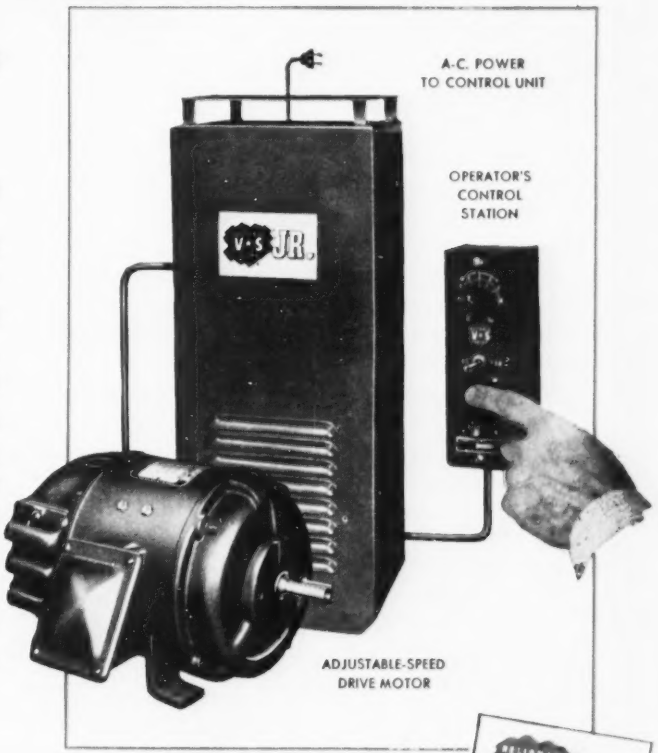
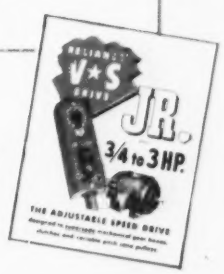


SAVES YOU MONEY 10 WAYS:

- Boosts output
- Cuts down rejects
- Saves space
- Increases safety
- Handles more jobs
- Reduces "down time"
- Simplifies machine design
- Reduces operator fatigue
- Cuts changeover time
- Operates from a-c.

GET THE FACTS!

Ask for Bulletin D-2102. It describes and illustrates features, applications, components and operation; dimensions and characteristics also are included.



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BILLETS AND FORGINGS FOR PRODUCTION, TOOL ROOM AND MAINTENANCE REQUIREMENTS

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"B" No. 3X HEAT-TREATED BARS

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CHUCKS, Quick Change and Safety
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Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Sculiy-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCroskey Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

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Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.
Starrett, The L. S., Co., Athol, Mass.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS
Brown & Sharpe Mfg. Co., Providence, R. I.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

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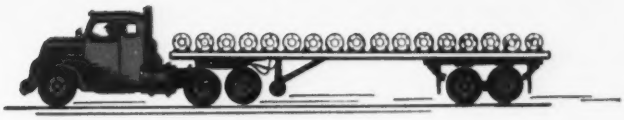

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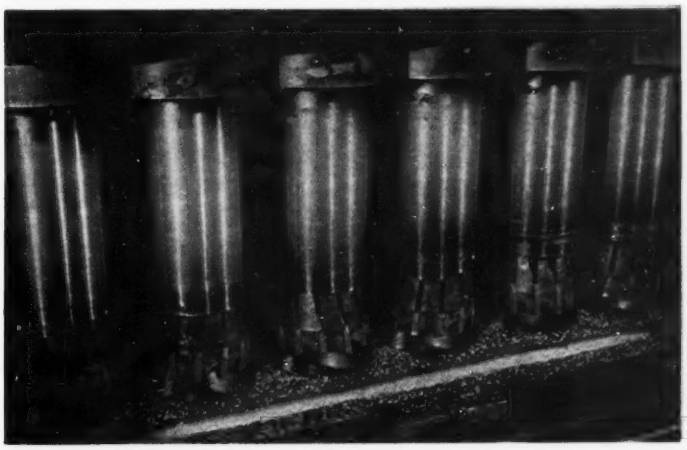

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Farm Implement Mfg. Co.

Machine	Ingersoll Boring Mill—6 spindle
Part	Cylinder block
Operation	Rough cylinder bore
Tools	3 R.H. and 3 L.H. Wesson Fine Pitch Cutters—3.480 dia.—12 Wessonmetal Solid GI Blades
Speed	148 S.F.M.
Stock Removel	3/16"
Feed	10" per min.—.063 per revolution
Length of Cut	8⅞"

OVER 300% DOLLAR SAVINGS PER TOOL

OLD METHOD		NEW WESSON METHOD	
Pieces per Grind	836	Pieces per Grind	3160
Cost of Tool	$49.68	Cost of Tool	$172.80
Grinding Cost per sharpening	$11.70	Grinding Cost per Sharpening	$8.78
Tool Cost per 100 Pieces	$2.588	Tool Cost per 100 Pieces	$0.642

On only one machine with Wesson Tools Savings of over $900 per year

HOW IS YOUR PRODUCTION SCORE CARD!

Write today for folder on Wesson's educational, full color, sound movie—"This Carbide Age."

WESSONMETAL Cemented Carbide

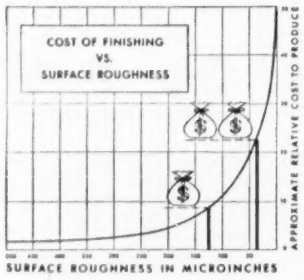
WESSON METAL CORPORATION

LEXINGTON, KENTUCKY

Affiliated with WESSON COMPANY, Detroit, Mich.

Surface finish control can reduce *your* machining costs

PROPER surface finish control may well yield big savings in your plant by reducing production costs, increasing production rates, and improving product performance.



The chart shows how finishing affects the cost of machined parts. For example, if the surface finish is specified as 125 microinches and you are overfinishing to 32 microinches because of lack of proper gaging equipment, your finishing cost can be twice as much as necessary. To eliminate costly overfinishing, actual checks of machined surfaces should be made in the shop to be sure that specified values are met *but not exceeded.*

With surface finish control you can eliminate unnecessary operations and operate more efficiently. It helps you improve your products, since surface finish affects many factors in performance, such as break-in time, wear, heat transfer, lubrication, etc.

A new method of Surface Finish Control

THERE is now a simple method of measuring surface roughness on the production line so that the benefits of surface finish control can be realized. The Brush SURFINDICATOR* is a portable inspection tool . . . easy-to-use . . . accurate. This new instrument makes surface roughness measurement a practical shop operation.

*Trade Mark

Get the complete story—get your copy of this new booklet on Surface Finish Control. It offers you the key to reduced machining costs, more efficient use of equipment, and improved products. Write Brush Electronics Company, Dept. Y-11, 3405 Perkins Avenue, Cleveland 14, Ohio.

BRUSH ELECTRONICS COMPANY

formerly
The Brush Development Co.
Brush Electronics Company
is an operating unit of
Clevite Corporation.

INDUSTRIAL AND RESEARCH INSTRUMENTS
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MAGNETIC RECORDING EQUIPMENT
ULTRASONIC EQUIPMENT

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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

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Eastman Kodak Co., Rochester, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York,

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

COMPOUNDS, Resin and Molding

Bakelite Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
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Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
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Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee,
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CONTROLS, THERMO

Control Products, Inc., 306 Sussex St., Harrison, N. J.

(*Continued on page* 388)

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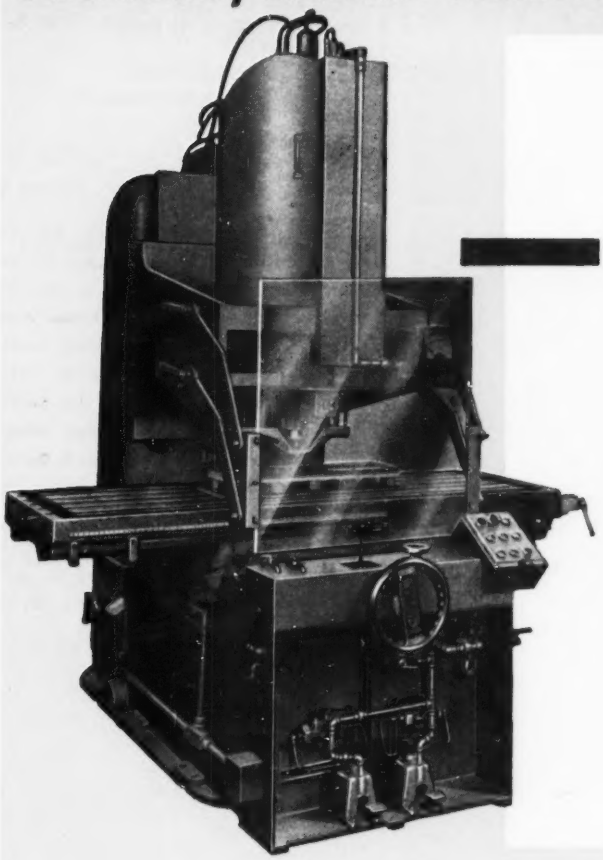
sensationally different! unbelievably fast! for milling aluminum

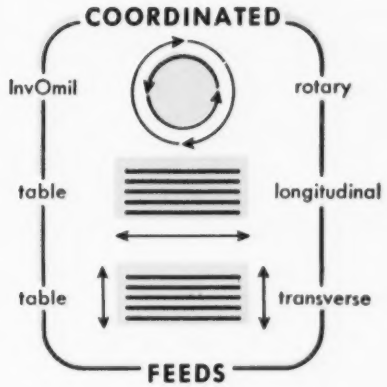


the new

Onsrud®

A-42
Profile Milling Machine

equipped with the famous
Onsrud patented system of



for hi-speed hi-feed nonferrous profile milling

Whatever the curve or the contour, here's the machine to give you production speeds never before thought possible. Automatic template-controlled precision . . . easily taught operation . . . production speeds up to 500% faster. Secret of speed is the coordinated triple power-feed of the milling head and table. Rate of feed is extremely fast without slow-up or stop in contour cuts or right angle corners. Direct drive cutter motor is Onsrud air cooled two-speed 15-30 HP, 7,200-14,400 RPM unit.

Designed and built under the same basic design principles as the larger capacity A-72 InvOmil Profile Milling Machine. For complete information . . . *write today for the new Onsrud A-42 Profile Milling Machine Bulletin No. 1145.*

FOR THE MILLING OF NON-FERROUS METALS IT'S Onsrud HI-FEED HI-SPINDLE-SPEED MACHINES

ONSRUD MACHINE WORKS INC. 3940 Palmer Street Chicago 47, Illinois

KELLER Air Tools

where Extra Power is needed

ANOTHER EXAMPLE OF
KELLER *Air Tools engineered to industry*

FACTS IN BRIEF ABOUT KELLER NUT SETTERS

Weigh less

Consume less air

Interchangeable parts

Reduce operator fatigue

Torque controlled from 20 to 70 ft/lb

Running down and tightening the nuts which attach hinge arms to an automobile hood requires a nut setter with extra power. The Keller 16-C Nut Setter has an especially powerful motor capable of handling machine screw nuts up to ⅝". . . yet for all its power it is light in weight and easy to handle.

In the illustration above, the 16-C Nut Setter is provided with a 90° attachment to deliver power at a more convenient angle.

Keller Air Tools deliver more power per pound — speed production and reduce costs. We would like to tell you more about them.

Wide variety of handles, gearings, speeds, and angle attachments

Send for
FREE 36-Page Booklet
for more information and interesting ideas on air tool application

Keller Tool Company, Grand Haven, Mich.

Please send me a free copy of your booklet on Pneumatic Screw Driving and Nut Setting Tools

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Company _____

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COOLANT SEPARATORS
See Separators, Oil or Coolant.

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Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa

COUNTERSINKS
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Peck, Stow & Wilcox Co., Southington, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUNTING DEVICES
Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUPLINGS, Fluxible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page* 390)

For more information on products advertised, use Inquiry Card, page 261

ERIE HAMMERS

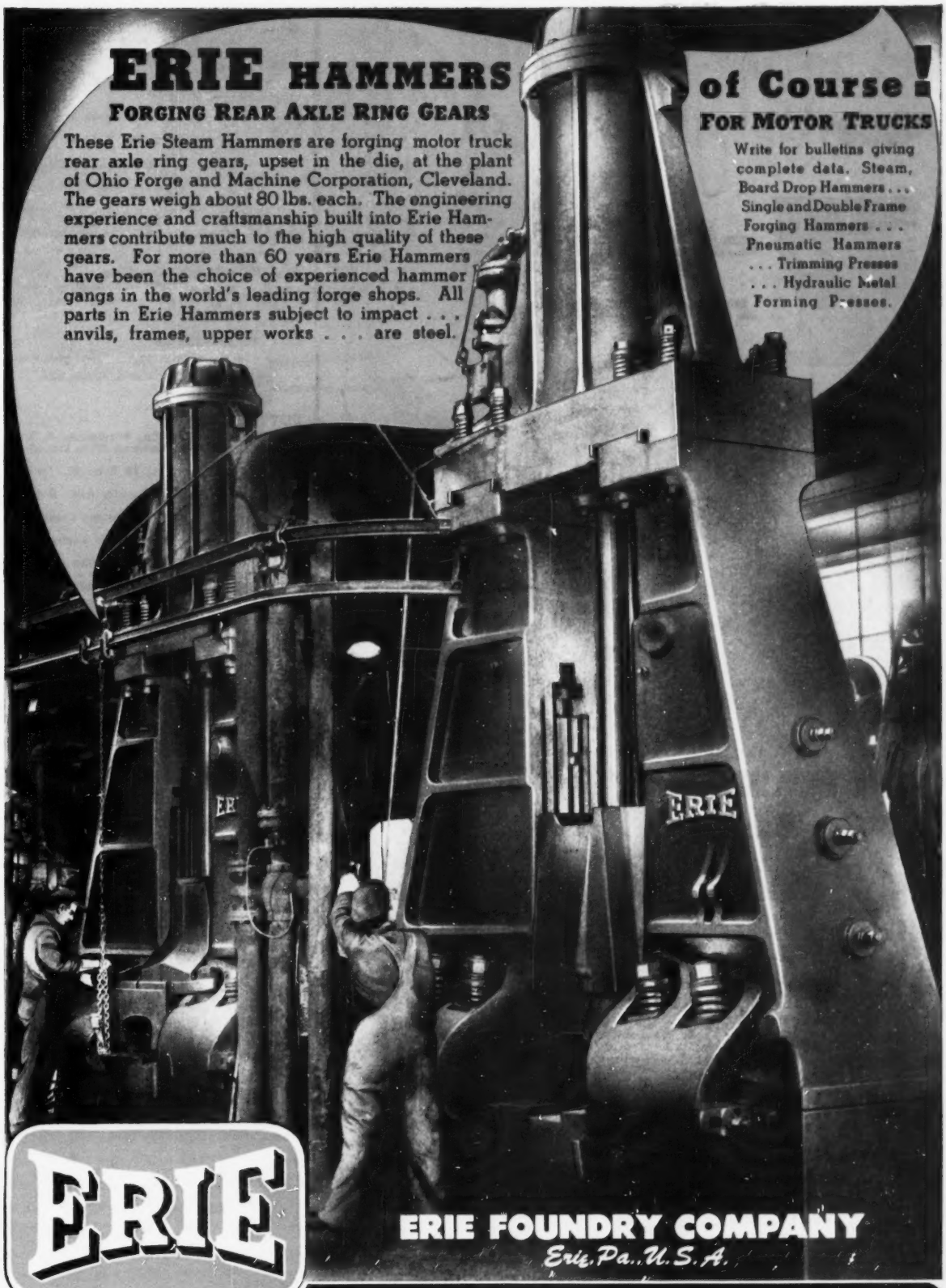
FORGING REAR AXLE RING GEARS

These Erie Steam Hammers are forging motor truck rear axle ring gears, upset in the die, at the plant of Ohio Forge and Machine Corporation, Cleveland. The gears weigh about 80 lbs. each. The engineering experience and craftsmanship built into Erie Hammers contribute much to the high quality of these gears. For more than 60 years Erie Hammers have been the choice of experienced hammer gangs in the world's leading forge shops. All parts in Erie Hammers subject to impact . . . anvils, frames, upper works . . . are steel.

of Course!

FOR MOTOR TRUCKS

Write for bulletins giving complete data. Steam, Board Drop Hammers . . . Single and Double Frame Forging Hammers . . . Pneumatic Hammers . . . Trimming Presses . . . Hydraulic Metal Forming Presses.



ERIE

ERIE FOUNDRY COMPANY
Erie, Pa., U.S.A.

ERIE BUILDS *Dependable* HAMMERS

LEBANON Castings are at work

SPANIARDS marvel at these Talgos that flash by on the Madrid to San Sebastian run. Developed by Spanish and United States designers, built by American Car & Foundry Company, the Talgos are more than streamliners. They are an entirely new concept in railroading! The economical, light-weight Talgos hug the rails, safely rounding curves at 80 to 90 MPH, reaching 130 MPH on the straight-a-ways. And *all* the alloy castings in these remarkable trains are Lebanon CIRCLE Ⓛ . . . 22 for each train*.

In programs requiring creative effort you'll find Lebanon engineers and metallurgists working directly with the designers to produce castings with outstanding characteristics. Such a program created *the Talgo . . . el tren de mañana!*

See—STEEL WITH A THOUSAND QUALITIES—37 min., full color sound film on the making of steel castings. For information write: Dept. X, Lebanon Steel Foundry.

*Made of CIRCLE Ⓛ 205, a light-weight, strong and tough alloy. Typical castings are illustrated above.

LEBANON Castings

CARBON, SPECIAL ALLOY AND STAINLESS STEEL

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Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Southwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429 Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32 Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.

(*Continued on page* 392)

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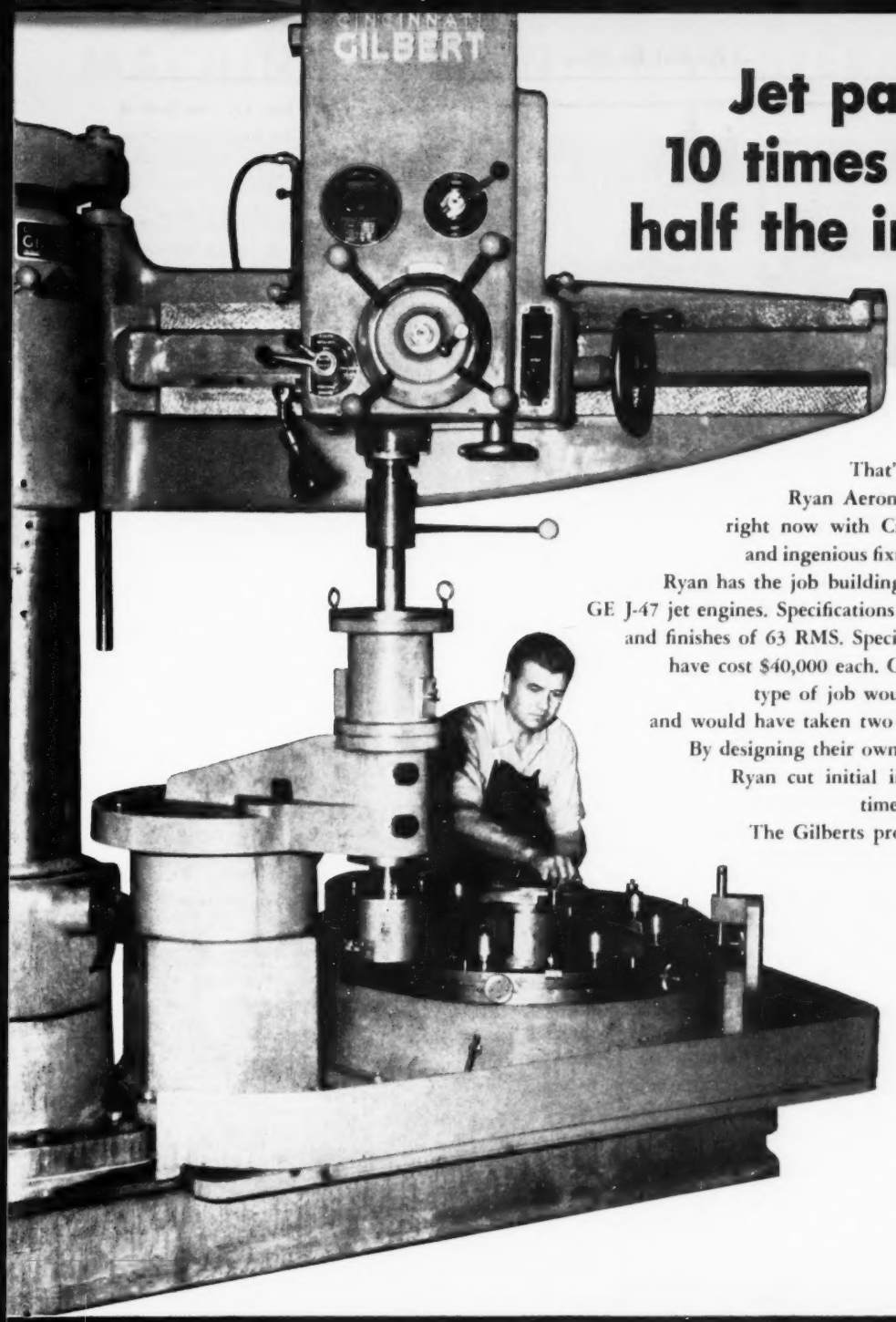


Jet parts drilled 10 times faster for half the investment

That's quite a story. But it's true. Ryan Aeronautical engineers are doing it right now with Cincinnati Gilbert radial drills and ingenious fixtures they designed themselves. Ryan has the job building stainless steel aft frames for GE J-47 jet engines. Specifications demanded tolerances of .005" and finishes of 63 RMS. Specially-designed machines would have cost $40,000 each. Conventional machines for this type of job would have cost equally as much, and would have taken two days to complete each frame. By designing their own fixtures to attach to Gilberts, Ryan cut initial investment in half, machining time from two days to *two hours.* The Gilberts provide the rigidity, power, and responsive controls so vital to precision jobs.

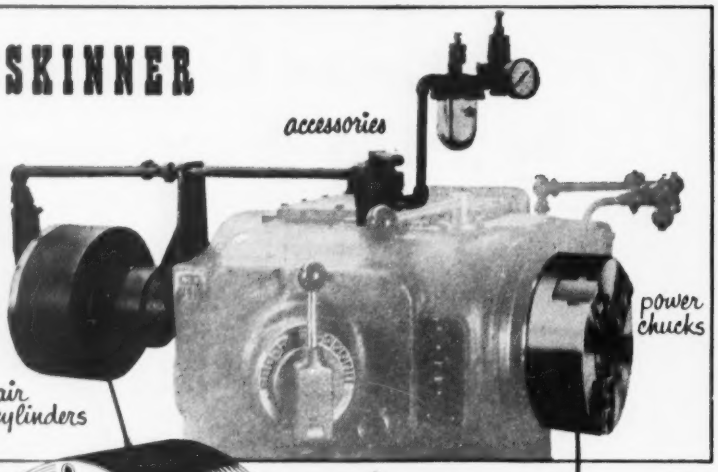
Clean design and rugged construction make Gilberts pay high returns on your investment. Quick response to controls, with minimum effort, plus positive "no-drift" clamping, help Gilbert operators get more work done accurately and faster. 9" and 11" columns. Thirty-day delivery. Ask your Gilbert representative to demonstrate why "those who buy Gilbert buy Gilbert again," or write for Bulletin 349.

GILBERT

THE CINCINNATI GILBERT MACHINE TOOL COMPANY • 3366 BEEKMAN STREET, CINCINNATI 23, OHIO

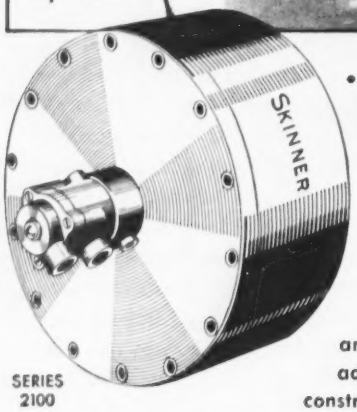
SKINNER

accessories



power chucks

air cylinders



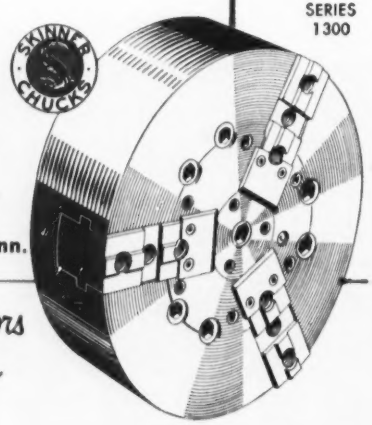
SERIES 2100

...for every high production need!

The Skinner line of power chucking equipment has the strength, rigidity and design features so essential for today's production needs. Chucks are available from 6" to 21" with forged steel bodies, and with either 2 or 3 adjustable or non-adjustable jaws. Exclusive sliding wedge construction grips internal or external work positively regardless of jaw position. The chuck will not release the work, even if air line is broken, until operator actuates the draw bar. Skinner double-acting rotating (series 2100 for speeds up to 1500 R. P. M.) and non-rotating air cylinders are available with semi-steel bodies for all sizes of Skinner power chucks, and for actuating all types of holding fixtures and tailstocks. Series 2200 double-acting rotating air cylinders have aluminum bodies for efficient operation up to 3000 spindle R. P. M. Skinner accessories include hand-operating valves — complete air unit, including regulating valve, pressure gage and lubricator — filters — soft blank top jaws; draw bars — draw tubes, etc.

Write for catalog giving complete details on the Skinner line of power and manually operated chucks. And ask about new movie "Chucks and Their Uses" — available for free showings.

SERIES 1300



THE SKINNER CHUCK COMPANY

206 Edgewood Ave., New Britain, Conn.

Sold by leading distributors in every industrial area

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National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
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Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwry., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 14230 Birwood Ave., Detroit 4, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).
Pines Engineering Co., Inc., Aurora, Ill.

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburg 8, Pa.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 394)

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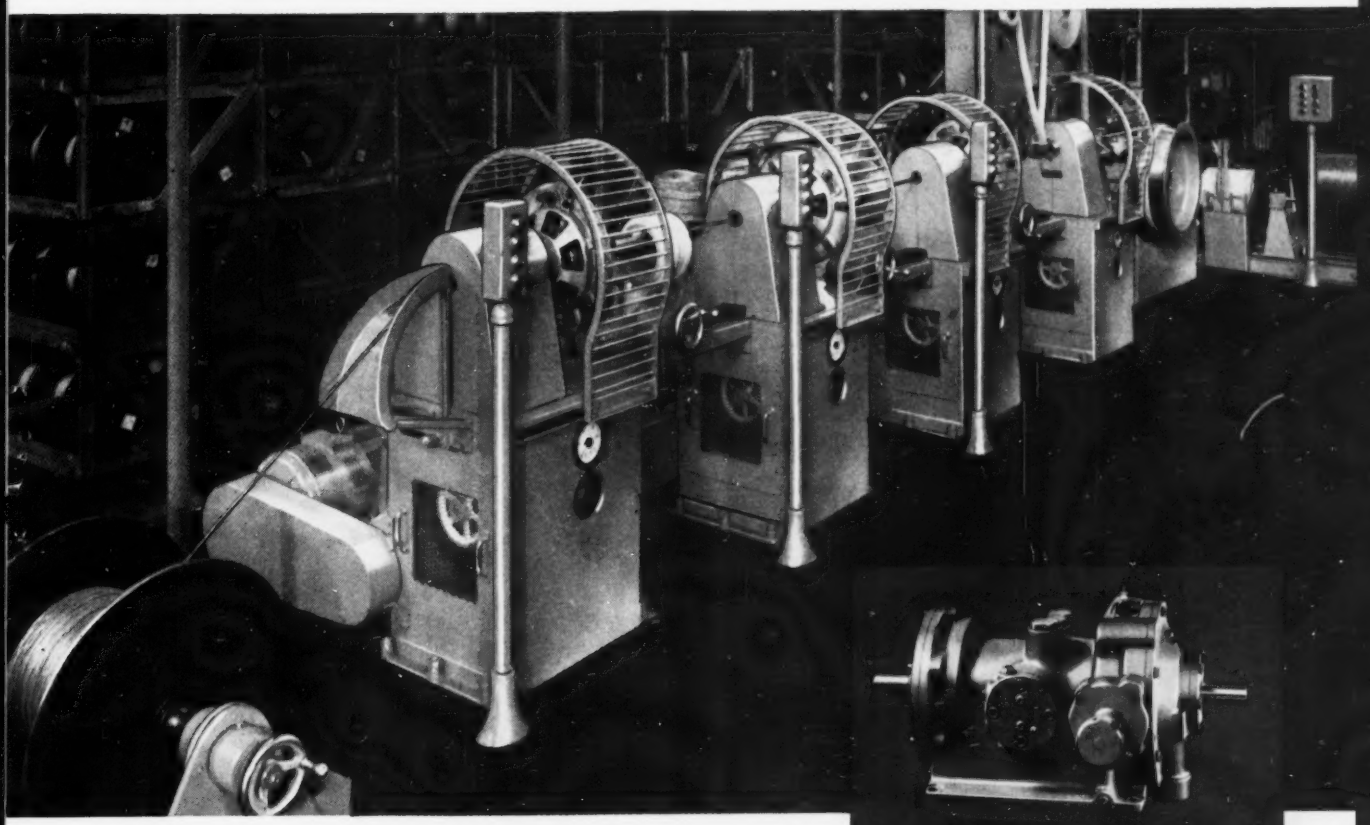
MACHINE DESIGN AT WESTERN ELECTRIC



Its use of Oilgear Fluid Power

Western Electric Company, manufacturing unit of the Bell Telephone System, originates, designs and builds many of the special machines it uses in its own manufacturing processes. It also maintains unceasing pressure to improve upon machines already in operation, for optimum performance, for better product, for lower costs, for freedom from trouble.

Its use of Oilgear Fluid Power Drives and Transmissions has been increasing because, in the words of their engineers, Oilgear enables them among other things to synchronize many machine components easily and economically. A good example of all these points is the "short haul" video cable wrapping machine pictured above.

This machine was designed and built by the company's own men some years ago. For optimum performance, the speed of the heads should be easily and independently variable and the direction of rotation instantly changeable because the lay and pitch of the wrappings must be varied according to the requirements of the run. Moreover, the inside contour of the tube formed by the wrapping should be smooth and uniform so as to avoid setting up echo waves that interfere with transmission and vitiate signal strength.

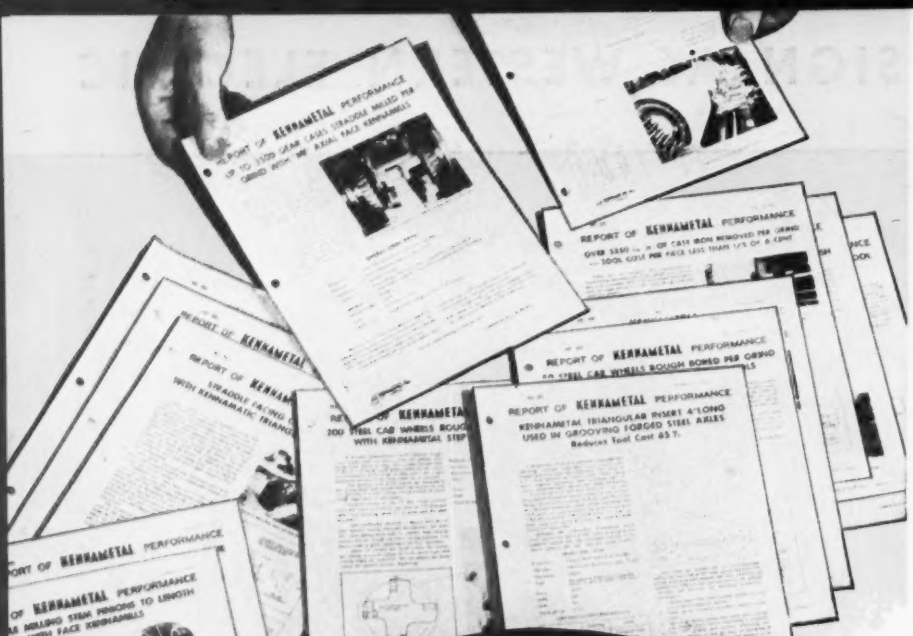
Because of these requirements, a new drive was installed something over 4 years ago. A line shaft drives five Oilgear Fluid Power Transmissions, one at each machine head and the capstan.

The results were these: uniformity and control of tension are so good, the machine runs at 4 times its former machine speed; it is easy to vary speed and direction of rotation of each individual head; eccentric heads gave way to concentric heads, and supply spools are now loaded to full capacity instead of ¼th to ⅛th as before; the machine is stopped less frequently for loading. Maintenance on the former drive was involved and frequent—on the Oilgear equipment it has been simple and negligible.

There is some reason to suspect that Oilgear Fluid Power with its wide range of advantages may solve some of *your* machine design problems and make the results very pleasing and profitable. Why don't you really find out? THE OILGEAR COMPANY, 1569 West Pierce Street, Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR



HOW TO CALL THE TURNS ON METALWORKING JOBS . . .

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Ability to predict with a high degree of certainty the results obtainable from a cutting tool is a worthwhile asset — developed through knowledge and experience, acquired either firsthand or from other users of known repute.

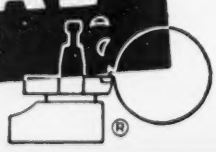
It's a satisfaction to know beforehand that the tool chosen for a job will turn out well — has inherent properties that assure consistently good performance.

Foresighted metalworkers have learned to rely on Kennametal. It is noted for doing one good job after another, day in and day out, as demonstrated by scores of regularly-issued Performance Reports.

Our accumulated knowledge and experience on how to "call the turns" on a wide variety of applications is yours for the asking. Our Field Engineers will be glad to help you. Kennametal Inc., Latrobe, Pa.

KENNAMETAL

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY



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Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

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Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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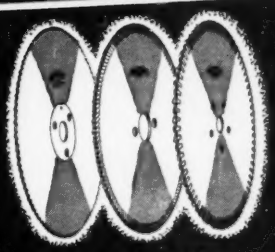
(*Continued on page* 398)

Here's a "Short" of SIMONDS Metal-Cutting Line



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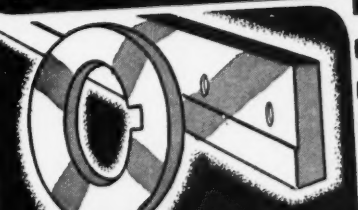

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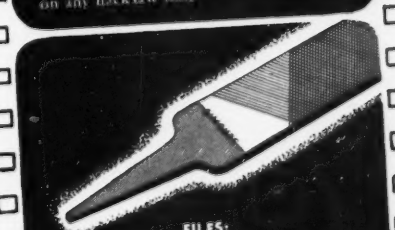
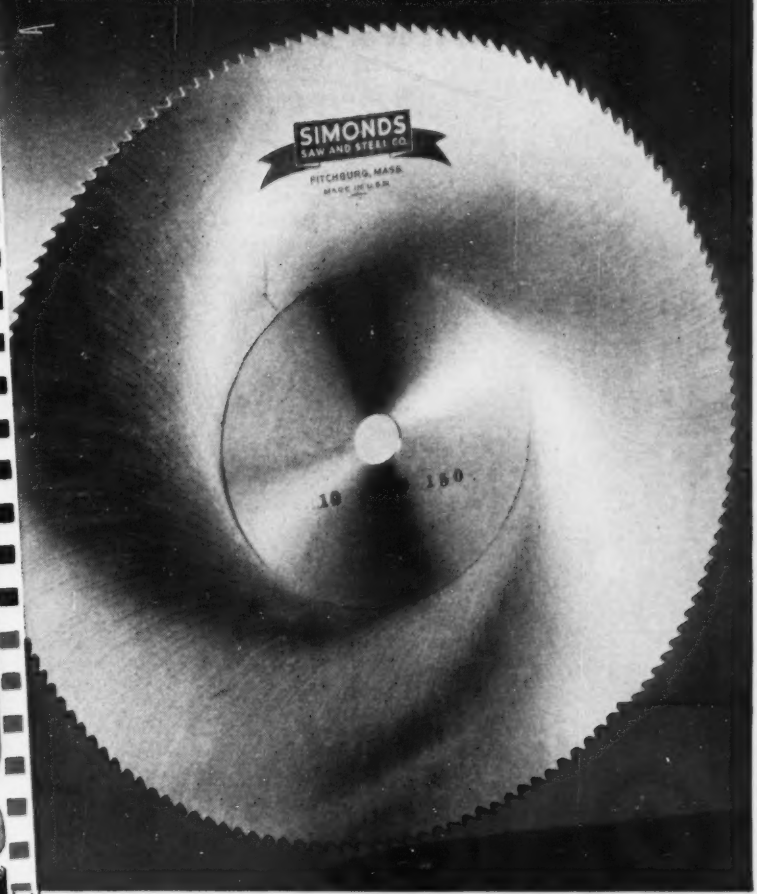
Famous "Red End" Blades for hand or power cutting . . . for top money's worth on any hacksaw job.



FILES:
Only Simonds "Red Tang" has the teeth like a metal-cutting saw . . . teeth that remove more metal with less effort.

TOPS for ALL NON-FERROUS CUTTING



On all non-ferrous metals, here's the toughest, most "stand-up-and-take-it" saw made . . . with a proven production record on everything from light-wall sections to solids.

SIMONDS heat-treats these saws for individual applications, according to speed, type of material, and machine. And SIMONDS design assures top cutting efficiency . . . with correct tooth-shape that eliminates clogging of gullets . . . with high, smooth finish that resists adherence of chips to plate . . . and with proper clearance for freer, cooler, straighter cutting.

Standard sizes are immediately available from stock . . . so see your Simonds Distributor *today*.

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MACHINE OF

MODEL "LR" *Lo-swing* LATHE AUTOMATICALLY TURNS, FACES AND CUTS BANANA GROOVE IN CAMSHAFTS

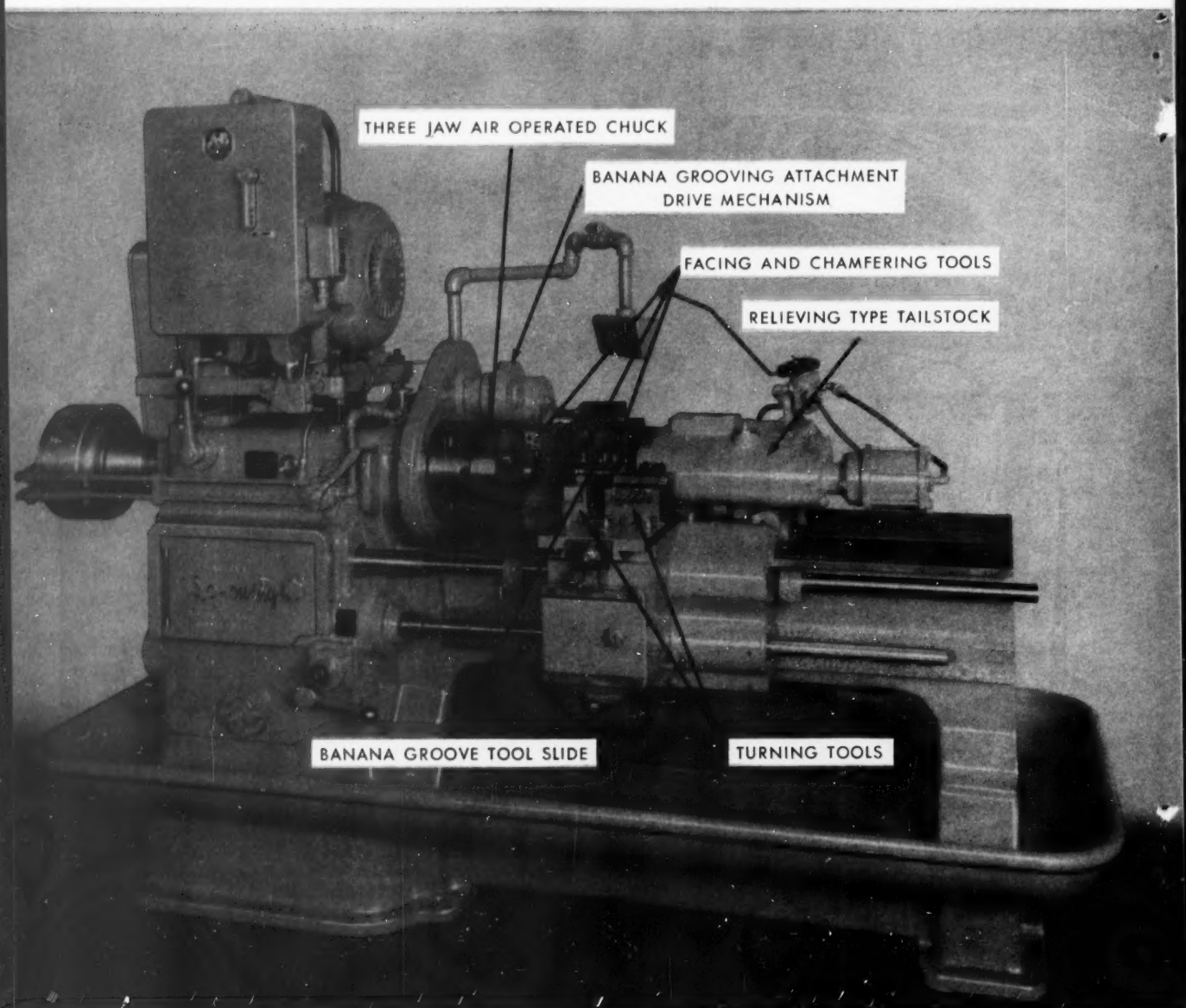

Fig. 1. *Model "LR" Lo-swing Lathe tooled for first operation.*

PRODUCTION COSTS

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PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

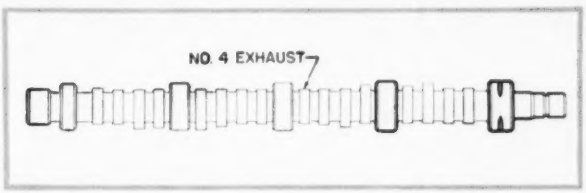


Fig. 2. *Heavy lines indicate machining performed in first operation.*

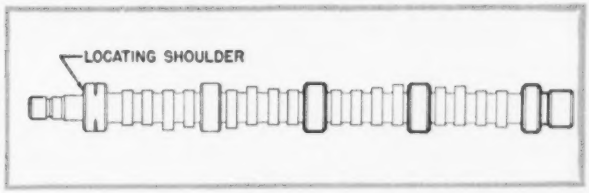


Fig. 4. *Heavy lines indicate machining performed in second operation.*

PROBLEM: **To turn, chamfer and face all bearing and gear fit diameters and cut banana oil groove in definite relation to No. 4, exhaust cam on automotive camshafts.**

SOLUTION: **Two Model "LR" Automatic Lo-swing Lathes were tooled to handle this job in two operations as follows:**

First Operation. **Camshafts are delivered to the machine with both ends faced, centered, and straightened to required tolerance. The first operation lathe is fitted with a large bore headstock spindle and a special 3-jaw, air-operated chuck (Fig. 1). This spindle carries a center, located deep in from the chuck face, to support and locate the camshaft. The opposite end is supported on a revolving tailstock center. The relieving-type tailstock swings clear to permit straight-line work loading.**

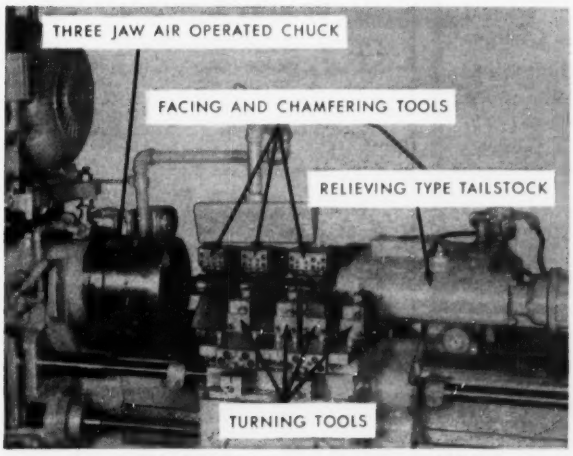


Fig. 3. *Model "LR" Lo-swing Lathe tooled for second operation.*

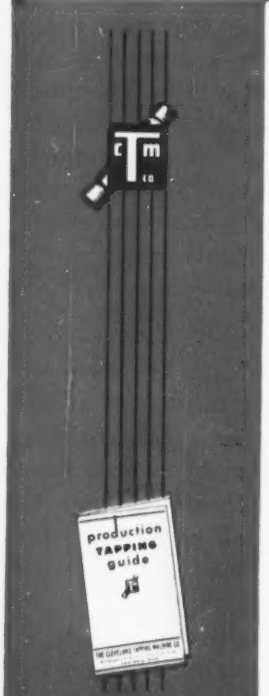
Before loading, the operator attaches a clamp dog, which fits into a groove in the chuck face, to No. 4 exhaust cam. This positions the camshaft in radial relationship to the timing of the banana grooving attachment, which is driven from the headstock spindle. High spindle speeds and coarse feeds with insert type carbide tools are possible with this drive which reduces unsupported length and insures extreme rigidity.

Second Operation. **This lathe is equipped with the same chuck and tailstock but the banana grooving attachment is omitted (Fig. 3). The camshaft is accurately located from the previously-machined shoulder (Fig. 4). A spring-loaded headstock center insures seating of the camshaft shoulder against the three-point locating stop within the spindle-bore. The camshaft is held and driven on No. 2 bearing, again minimizing unsupported length and providing maximum rigidity.**

Camshafts being machined are made of a special grade of cast iron. Hourly production at 100% efficiency is 90 camshafts. Bring *your* turning problems to Seneca Falls.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

ARE LOWER WITH Lo-swing



This Tapping Guide has invaluable information for engineers and operators. Send for your copy.

To get maximum speed on larger bushings Cleveland designed this Duplex machine with a 6 station hydraulic table. It will drill and tap 1¼" to 2½" bushings with a production of 730 pieces per hour of the 2½" size at 100% efficiency. Production of smaller sizes is of course considerably higher.

Like all Cleveland Tapping Machines it utilizes the now famous precision lead screw feed that assures you of more perfect pieces at top speeds. The result is lower costs.

Keep in mind that over the years Cleveland engineers have been designing special tapping machines to meet a varied range of requirements, often combining several operations in one machine. This accumulated know-how can be put to work for you. A machine designed by Cleveland engineers to meet your special requirements will definitely result in lower production costs.

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A Subsidiary of
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For Better Tapping - - Faster!
CLEVELAND lead tapping machines screw

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Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
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(*Continued on page* 400)

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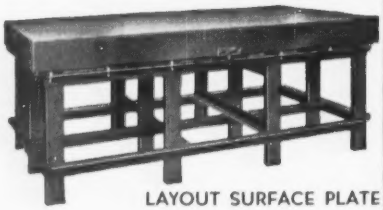

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(*Continued on page* 402)

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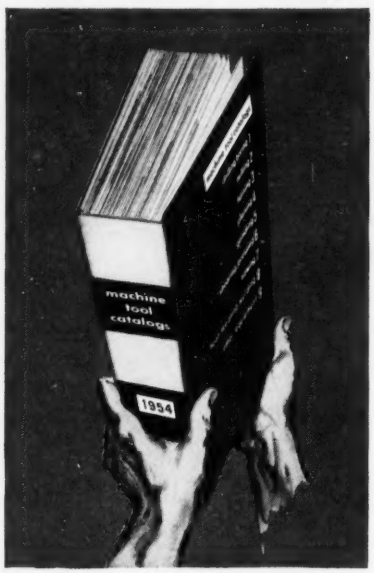

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Reid Bros. Company
Sheffield Corporation
Taft-Peirce Manufacturing Company

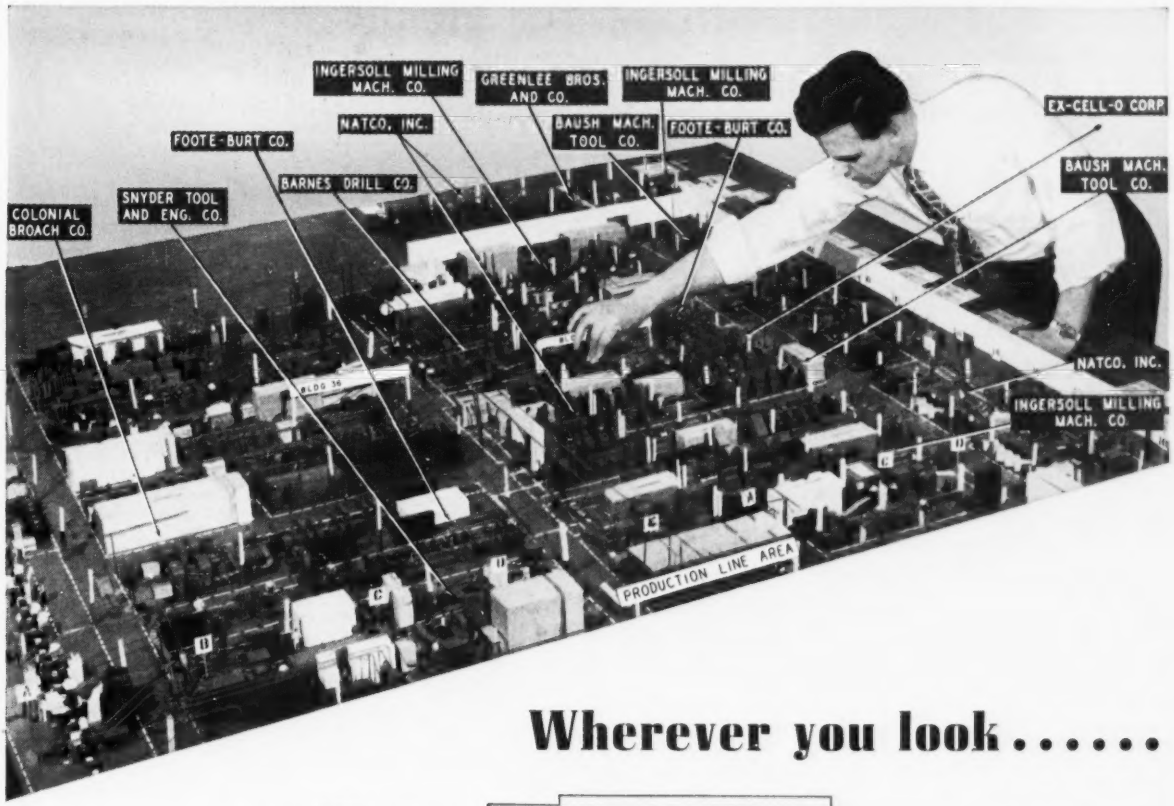
In other sections of the File you will find additional catalogs containing useful information on a wide range of machine tools and accessories.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street,
New York 18, N. Y.

For more information on products advertised, use Inquiry Card, page 261

In this Modern Automobile Engine Plant



Wherever you look.....

you'll see VICKERS® HYDRAULICS

Here is a scale model of the production line area of one of the most modern automobile engine plants ever built. Having a capacity of 100 V8 engines per hour, it is equipped with time-and-money-saving machinery for automation.

Wherever you look in this plant you'll see Vickers Hydraulics. This is indicated on the photograph by the lines leading out from the Vickers-equipped machines to the names of their makers. It is an interesting study . . . first for the variety of machines . . . second for the large number of builders who use Vickers Hydraulics. Vickers Hydraulics is often the ideal solution to the myriad problems of feed, control, transfer, synchronization, etc. which must be dealt with in a highly automatized plant such as this. Hydraulic power can be developed wherever most convenient and applied at any other location. Simplification of design, flexibility of control, instantaneous response, rapid operation, ease of providing interlocks and overload protection, low maintenance . . . all are characteristics of Vickers Hydraulic Systems.

Do your machines have Vickers Hydraulics? The Vickers Application Engineer near you will be glad to discuss the many advantages.

6445

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1403 OAKMAN BLVD. • DETROIT 32, MICH.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES (Metropolitan) NEW YORK (Metropolitan) • PHILADELPHIA (Metropolitan) • PITTSBURGH • ROCHESTER • ROCKFORD • SEATTLE • TULSA • WASHINGTON • WORCESTER

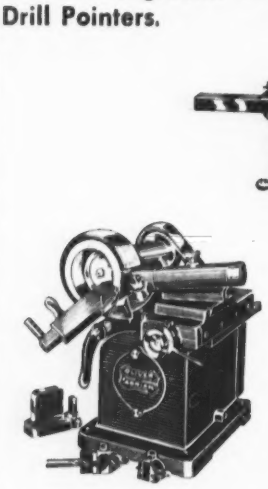
Keep Your Toolroom Up to Schedule with . . .

OLIVER DRILL POINTERS

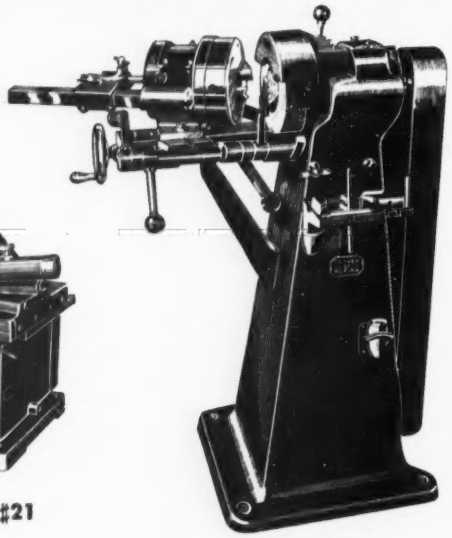
BE WISE OLIVERIZE

Be Wise, OLIVERize . . . Open your toolroom door to Oliver Drill Pointers. They assure a balanced cut because each lip does equal work, eliminating excessive drill costs and imperfect holes usually traced to improper grinding. Start saving money now—the Oliver Way.

Tests prove that when properly machine ground, twist drill life is increased up to 300%. Oliver Drill Pointers sharpen drills to cut more accurately, last longer and produce more holes. They also reduce power costs. Added drilling pressure from poorly sharpened drills naturally increases the power load. This can't happen with drills ground to precision perfection on Oliver Drill Pointers.



MODEL #21



MODEL #510

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.

No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for our free Booklet
"How To Produce More Holes With Your Drills!"
See our catalog in Sweet's Directory

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

DRIFTS, Drill

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40690 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bellows Co., 230 W. Market St., Akron, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

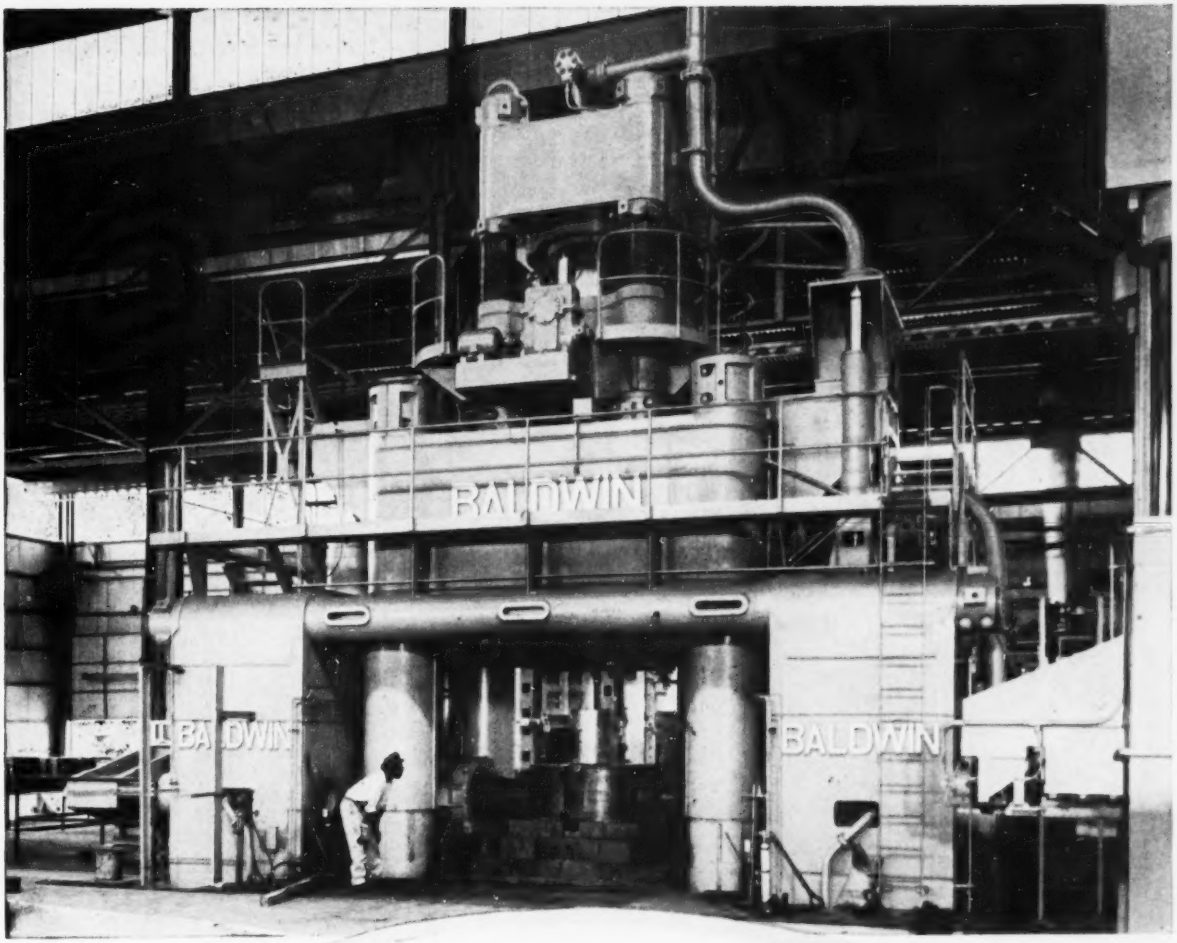
DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Thor Power Tool Co., Aurora, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kinasbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Machinery Co., 6402 West-

(*Continued on page* 404)



A NEW ERA IN STEEL FORGING

BEGINS IN HOUSTON

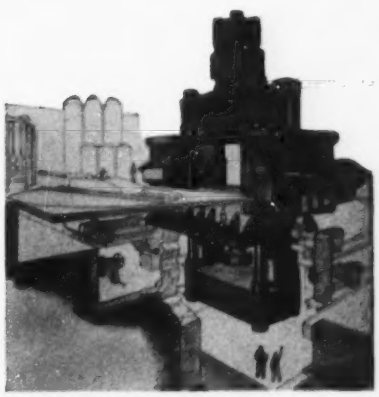
This new multiple ram forging press, the largest of its kind ever constructed, utilizes the Cameron Closed Die Extrusion Forging Process. The press forgings produced approach for the first time the broad field of intricate shapes that have been limited heretofore to steel casting. A new era begins in steel forging resulting in improved quality at a lower cost.

For further information write

FORGE AND ORDNANCE DIVISION

Cameron

IRON WORKS, INC.
HOUSTON, TEXAS



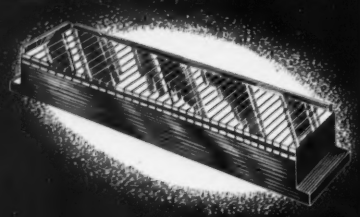
Main Ram — 11,000 Tons
Each Side Ram — 6,000 Tons
Piercing Ram — 3,000 Tons
Total Weight of Press — 3,100,000 lbs.

MAGNETIC CHUCKS BY

Magna-Lock

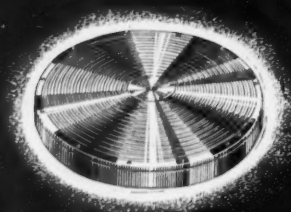
...largest exclusive builder of magnetic chucks

3 TYPES for every flat-surface machining job...large or small!



RECTANGULAR . . . work held to extreme edges of chuck. Sizes to 36" x 96".

ROTARY . . . inserted ring-type, 6¼" dia. to 48½" dia. Also sectional type for automatic loading, unloading.

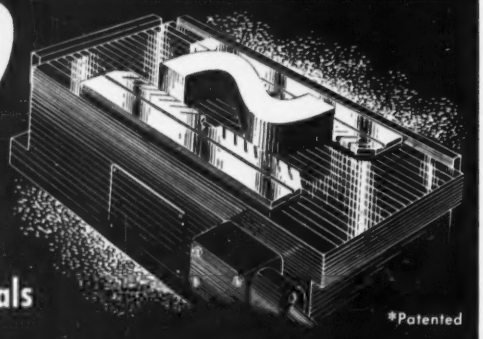


SWIVELING . . . for knife and shear blade grinding, many machining operations.

Get full details on Magna-Lock Magnetic Chucks and Devices.
WRITE DEPT.
M-113

HOLD

BRASS GLASS ALUMINUM ...any rigid non-magnetic materials on your MAGNETIC CHUCKS!



*Patented

Magna-Vise* DOES IT!

Hanchett MAGNA-LOCK CORPORATION

Magna-Lock

Magnetic Chucks and Devices

BIG RAPIDS MICHIGAN, U. S. A.

field Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Co., 19447 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland

DRILLING MACHINES, Deep Hole

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Bellows Co., 230 W. Market St., Akron, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K. Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horiz. Duplex

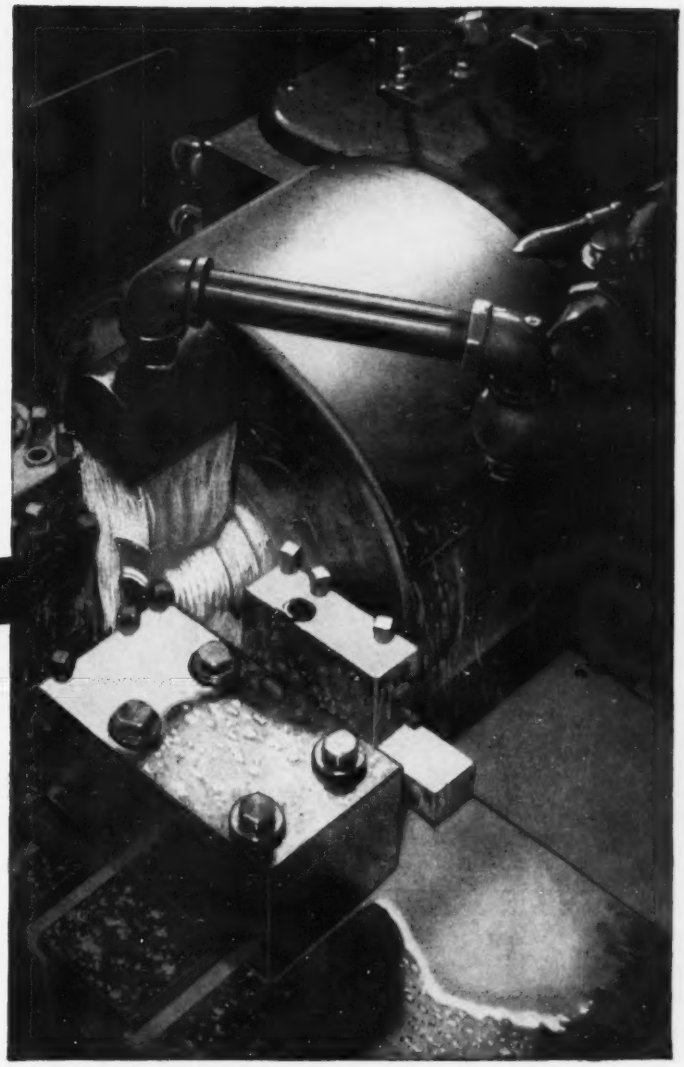
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.

(*Continued on page* 406)

For more information on products advertised, use Inquiry Card, page 261

YOU BE THE JUDGE FOR DASCO

SUPER SOLUBLE BASE



THE trial of Dasco in many plants has led to this judgment: Dasco Super Soluble Base is a heavy duty water-mix cutting fluid base of unusual versatility. It gives superior performance in mixtures of 1-40 and higher for turning, boring, reaming, drilling and milling and 1-100 and higher for grinding. Only unusual operations may require richer mixtures

TRIAL 1 OPERATION: Turning complete O. D. Nozzle insert for Rockets, B1117 steel

Dasco Performance: One part Dasco Super Soluble Base and 75 parts water on chucking machines increased tool life approximately 35%. Production increased from 50 to 400 pieces in 8 hours. Tool changes decreased from 27 tools per 8 hours using a competitive soluble oil to 12 tools per 8 hours with Dasco Super Soluble Base.

TRIAL 2 OPERATION: Drilling, counterboring and reaming 90MM Projectiles, A.I.S.I. 1055 forgings

Dasco Performance: Number of pieces per set of tools averaged 250 for a rich mixture of competitive heavy duty soluble oil. A 1-20 mixture of Dasco Super Soluble Base produced 500 pieces per set of tools.

TRIAL 3 OPERATION: Internal grinding of steel ring
Machine: Bryant Internal Grinder

Dasco Performance: A 1-150 mixture of Dasco Super Soluble Base replaced a 1-80 mixture of a competitive soluble oil. In addition the competitive product required a rust preventative. Dasco, even at the long dilution, has been in the machine over a month: no rusting has been experienced.

More Than a "Coolant" is Needed

D. A. Stuart Oil Co.
EST. 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS
2739 S. Troy St., Chicago 23, Illinois
In Canada: R. W. Horsey Canada, Ltd.
Subs. D. A. Stuart Oil Co., Ltd.
3575 Danforth Ave., Toronto

SEND COUPON FOR COMPLETE DATA
D. A. STUART OIL CO., Ltd.
2739 S. Troy St., Chicago 23, Illinois

Check One: ☐ Have Stuart Representative Call
☐ Send Data on Dasco

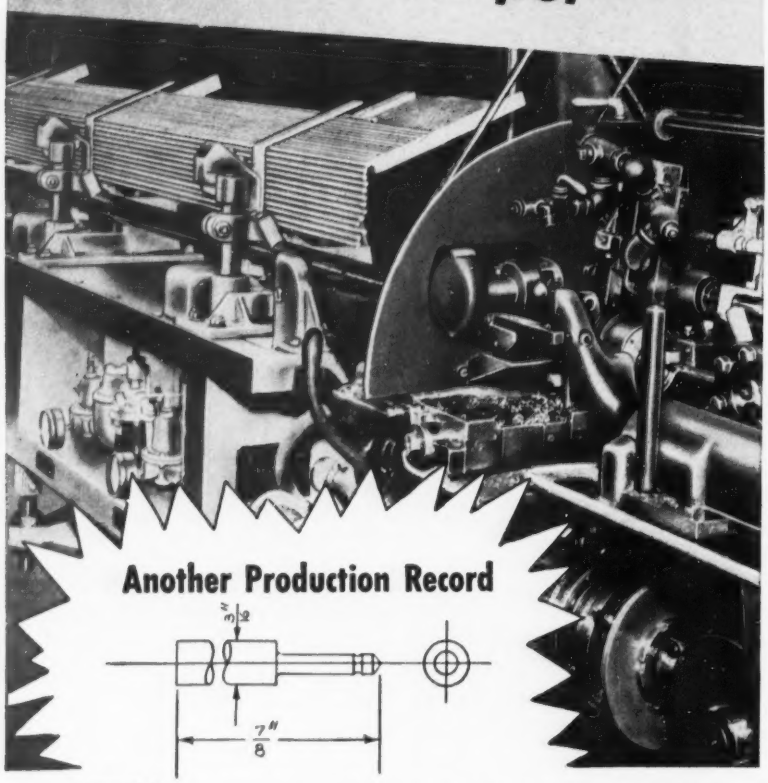
Your Name _____
(Please Print)

Title _____

Clip to Letterhead and Mail

Lipe Automatic Magazine-Loading BAR FEED

Increases Production 78% ...Eliminates Helper



Another Production Record

THE JOB—One operator attended four screw machines. One of these machines made the part shown above. Average production: 9,000 pieces per 10-hour day. To avoid "cutting air" and to step-up production, a helper was employed to assist operator to keep all four machines loaded. With the extra man, output was raised to approximately 12,000 pieces per day on the unit assigned to this particular job.

THE IMPROVEMENT—Lipe Automatic Magazine Loading Bar Feed was installed on this one machine. Then, operator was able to attend all four units . . . no helper any longer necessary! And the Lipe-equipped machine averaged *16,000 pieces per day*—78% more than original output!

THE LESSON—Lipe Automatic Bar Feeds *greatly increase production—even over closely supervised, hand-loading methods.*

BIG Production Gains on a wide variety of work, BECAUSE—

- Stock is fed to screw machine all the time—not dependent on operator.
- Pressure constantly behind stock.
- Eliminates feed fingers.
- Avoids multiple feed finger feed-outs.
- Model AML gives maximum output of machine—no "cutting air".
- Saves in changeover set-up time.

Get full details on how this machine will increase production and save you money. It's today's big advancement in screw machine stock feeding. Our engineers will gladly study your problem . . . no obligation.

Lipe-ROLLWAY CORPORATION
Manufacturers of Automotive Clutches and Machine Tools
Syracuse 1, N. Y.

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Associated Mch. Tool Corp., P. O. Box 9666, 535 McNeilly Rd., Pittsburgh 26, Pa.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.

(*Continued on page* 408)

For more information on products advertised, use Inquiry Card, page 261

Black & Decker

Cases for Comment

In thousands of cases, industry finds Black & Decker Power gives production a big boost

MAINTENANCE

(Case History 4820)

Black & Decker Drill, 16 years old...still going strong.

CONSTRUCTION

(Case History 7338)

Copper roof batting installed 20 TIMES FASTER than old methods with B&D Power.

PRODUCTION

(Case History 10691)

Black & Decker Drill speeds up production and operation 100%.

Hall-Neal, Indianapolis, Ind.

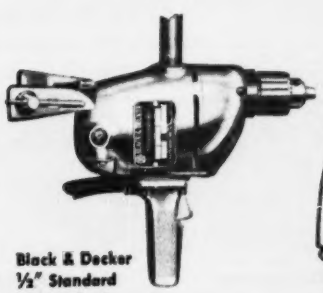
Hall-Neal manufactures furnaces, installs them and air-conditioning equipment. Photo shows ¼" B&D Drill used to drill hole in 22 gauge steel. Also used for general maintenance. The use of the drill has resulted in 100% speed up in operation and production. Company also uses B&D Screwdriver, Heavy Duty Grinder. Some on job 8 hours a day, 5½ days a week for 10 years.

Jim—Note this proof of long trouble-free service

Here's power to drive drills (and saws, grinders, hammers, screwdrivers) . . . produce more per machine . . . per man-hour.

Here's power *custom-built* for the job. Power built into every B&D Portable Electric Tool because every B&D Tool is driven by a B&D-built motor. And every B&D Tool is built to the latest design with husky housings, precision parts. Year in, year out you can depend on B&D Tools to do the job faster . . . saving time, trouble, money, and manpower.

Don't just take our word for it. Ask around industry. Ask production specialists. Ask time and motion experts. Then try Black & Decker Drills . . . Black & Decker Power. See your B&D Distributor for demonstration. And write today for free, detailed catalog. Address: THE BLACK & DECKER MFG. CO., 605 Pennsylvania Ave., Towson 4, Maryland.



Black & Decker ½" Standard Electric Drill

Black & Decker ¼" Heavy-Duty HOLGUN* Drill

LEADING DISTRIBUTORS EVERYWHERE SELL

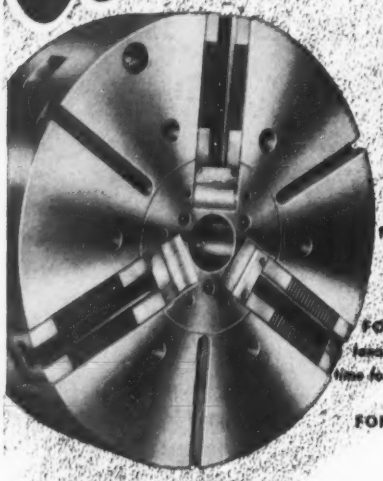
Black & Decker

PORTABLE ELECTRIC TOOLS

BD

* Trade Mark Reg. U. S. Pat. Off.

Whiton AIR CHUCKS



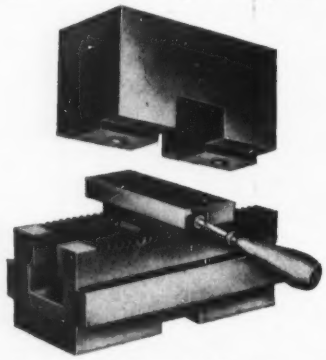
Equipped with American Standard Serrated Jaws and Whiton Micro Jaw-Sets.

FOR INCREASED PRODUCTION with less operator fatigue. Faster spindle speeds with safe, fast chucking of work.

FOR PRECISION ADJUSTMENT of chuck jaws. Maintenance of jaw settings during long runs. Less down time for adjustment.

FOR STANDARDIZED WORK-HOLDING EQUIPMENT

Whiton Air Chucks are engineered to give maximum efficiency and economy of operation. Sizes up to 12" are wedge-actuated for high speed spindle rotation. Larger sizes up to 36" are lever-actuated to give maximum holding power with minimum air consumption. Chuck body and jaws are made of selected steels and heat treated for strength and durability.



Whiton MICRO JAW-SET

An exclusive Whiton feature which, in combination with the American Standard Serrated Jaws, gives Whiton Chucks the rigidity of a non-adjustable chuck and provides for extremely precise individual jaw adjustment.

Whiton SINCE 1856

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall Radial

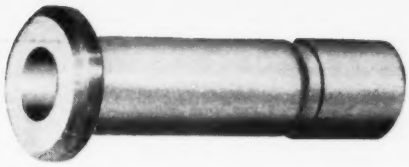
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

(*Continued on page* 410)

For more information on products advertised, use Inquiry Card, page 261



SUNNEN® HONING

PROVED THE PRACTICAL, ECONOMICAL WAY TO SIZE AND FINISH THIS VALVE GUIDE

Tough, High Carbon, High Chrome Castings are Honed Easily, Quickly

PROBLEM: To produce an accurate hole with a 20 micro-inch finish in high carbon, high chrome (25 to 28%) castings—at a reasonable cost.

MATERIAL: Chrome-Iron alloy casting
HARDNESS: 36 to 42 Rockwell "C"
HOLE LENGTH: 3.5"
HOLE DIAMETER: .6735
STOCK REMOVAL: .002" to .0025"
TOLERANCE: ± .0005"
FINISH: 20 micro-inches, RMS
MANUFACTURER: American Non-Gran Bronze Co.

SOLUTION: Sunnen Model MB1290D Honing Machine with K-20 type mandrels and 220 grit, medium hardness stones, and Sunnen Honing Oil. Only preparation is rough reaming.

RESULTS: Sunnen Honing is giving excellent results at less cost than any other method tried. Surface finish requirements are met easily. Semi-skilled labor is used. Production rate is 40 per hour, including individual gaging.

TYPICAL HONED PARTS

Cast iron hydraulic cylinder

Bronze motor bearing

Steel worm gear

SUNNEN PRODUCTS COMPANY
Manchester Avenue, St. Louis 17, Missouri
Canadian Factory: Chatham, Ontario

In plant after plant Sunnen Honing Machines have been the solution to production problems that could not be handled by drilling, reaming, boring, lapping, or grinding.

You'll find them economical for job lots as well as long production runs . . . for de-burring as well as micro-fitting . . . for producing holes to engineering specifications as well as for eliminating manufacturing bottlenecks.

These machines generate geometrically perfect holes with fast stock removal . . . produce a guaranteed accuracy of .0001" or better and surface finish to 2 micro-inches RMS . . . have a diameter range of ⅛" to 2⅝" . . . require no jigs or fixtures . . . are used in thousands of plants in production, tool room, maintenance, salvage. Average installation costs less than $1,000.

Sunnen Honing Machines may be *your* answer, too. Investigate now.

Mail the Coupon NOW for this Free Booklet

Sunnen Products Co.
7981 Manchester Ave., St. Louis 17, Missouri

☐ Send Free Booklet on Sunnen Honing

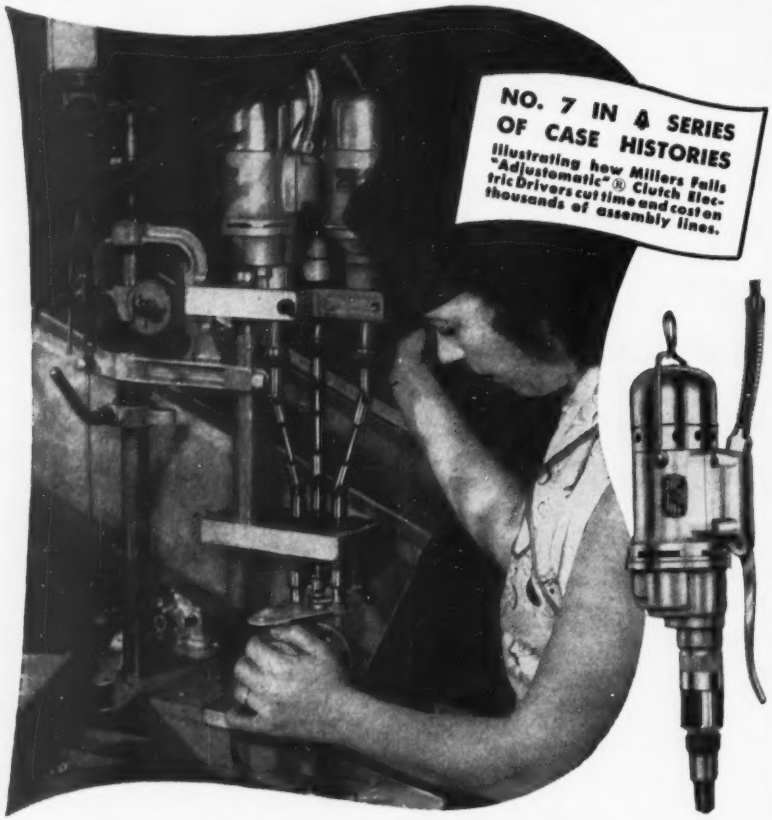
☐ Have A Field Engineer Call, no obligation

Name.....

Company.....

Address.....

City..... Zone..... State.....


NO. 7 IN A SERIES OF CASE HISTORIES
Illustrating how Millers Falls "Adjustomatic"® Clutch Electric Drivers cut time and cost on thousands of assembly lines.

AMERICAN BOSCH

. . . great name in automotive electrical equipment . . .

KEEPS PRODUCTION UP, COSTS DOWN

with Millers Falls Power Drivers

"TRIPLETS". Typical of the highly efficient Millers Falls installations at American Bosch are the ingenious three-driver applications shown above and in the main illustration. Both speed production of WWC wipers.

When it comes to really rough competition, few businesses are tougher than manufacturing original equipment for the automotive industry.

For many years, American Bosch has been a highly successful supplier of voltage regulators, electric windshield wipers and other automotive products. For years, too, Millers Falls No. 52 Electric Drivers with the *patented* "Adjustomatic"® Clutch have been *standard equipment* at American Bosch.

In multiple and single-unit applications, scores of these rugged, vibrationless drivers help keep costs at a minimum, hold torque specifications to rigid standards, and maintain peak production.

Whatever your driving problems, these powerful, high-speed tools with the super-sensitive "Adjustomatic"® Clutch can give you a big edge on competition. There are sizes and types for practically every driving operation. Write for full details — or let us arrange a demonstration.

MILLERS FALLS COMPANY
Greenfield, Mass.

MILLERS FALLS TOOLS
SINCE 1868
The Mark of Superiority

Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

DRILLS, Portable Pneumatic

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Bellows Co., 230 W. Market St., Akron, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cieco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Besly-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

(*Continued on page* 412)

For more information on products advertised, use Inquiry Card, page 261

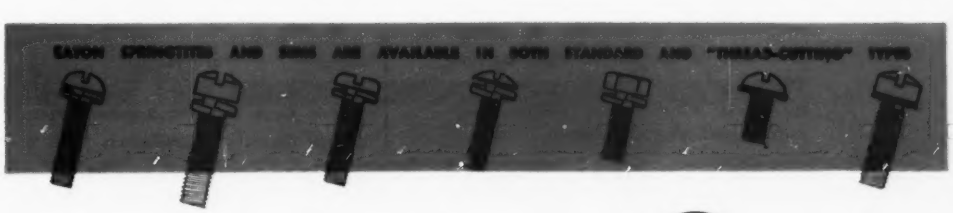
ELIMINATE
waste motions in production

SWITCH TO
Eaton Springtites and Sems

(Bolt or screw preassembled with spring lock washer)

The motions used by a production line worker on bolted assembly operations shown in figure 1 above differ from the motions used by the worker pictured in figure 2. This difference is graphically shown by light lines taken from actual factory production photographs. This difference in motions made possible by Eaton Springtites and Sems means higher production quotas and increased manufacturing profits. Why?

Because they are preassembled units, Eaton Springtites and Sems eliminate the need for assembling the spring lock washer on the bolt. Losses of separate washers and bolts are cut, while double requisitioning, purchasing, inventory is eliminated. Then too, Eaton Springtites and Sems are easy to use in hard-to-get-at places, and yet can be hopper fed for automatic screw driving. Most important, Eaton Reliance quality preassembled Standard ASA Spring lock washers and bolts assure greater product quality. See your nearest Reliance Sales Office for complete details on Eaton Springtites and Sems or write directly for Engineering Bulletin No. S-49.

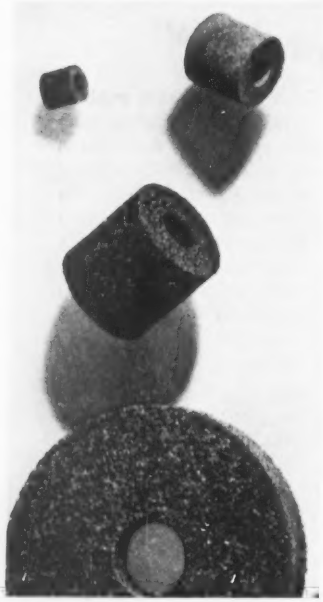


RELIANCE DIVISION EATON MANUFACTURING COMPANY

OFFICE and PLANTS: 507 Charles Ave. S.E., MASSILLON, OHIO

Springtites & Sems | Snap & Retaining Rings | Special Steels | Spring Lock Washers | Hex-Pac-Nut

Take the guess-work out of grinding...



SIMONDS ABRASIVE CO.

Grinding Wheels

Low-cost, high-efficiency grinding depends largely on careful wheel selection. Why take a chance? Choose safely with the help of Simonds bulletin on grinding wheel selection. It describes wheels for a wide range of jobs, gives recommendations for various types of materials . . . and lists specifications for easy ordering. Complete line has everything you need for roughing, finishing, cutting off, sharpening and polishing . . . everything including mounted wheels and points, segments and abrasive grain.

Write for free bulletin ESA-100, and name of your Simonds distributor.

SIMONDS ABRASIVE CO., PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON

DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N.Y. Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rickford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois, Detroit, Mich.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel.

EMERY WHEELS

See Grinding Wheels

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Bellows Co., 230 W. Market St., Akron, Ohio.
Federal Press Co., 600 Division and Big Four R. R., Elkhart, Ind.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
Sahlin Engineering Co., Birmingham, Mich.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

(*Continued on page* 414)

For more information on products advertised, use Inquiry Card, page 261

Everything You've Ever Wanted From a Clutch!

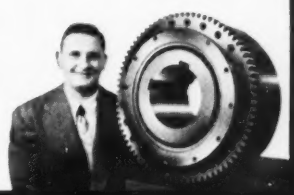
FULL COMPLEMENT

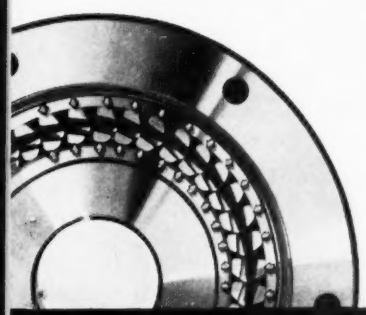
FORMSPRAG Clutches

OVER-RUNNING · BACKSTOPPING · INDEXING

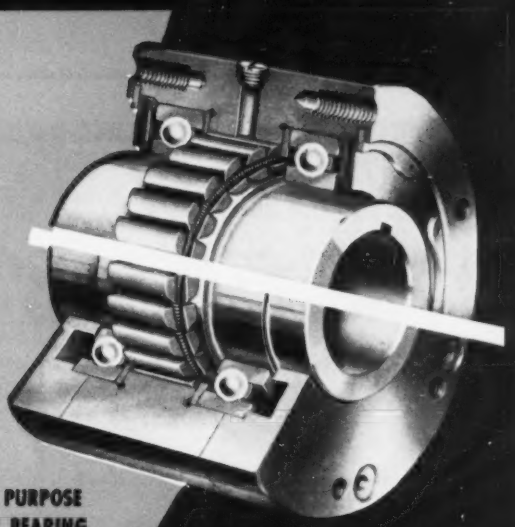
TELL US ABOUT *YOUR* APPLICATION
Should it be as small as this one for a duplicating machine . . .

or as large as this one for an oil well rig—you'll want THE CLUTCH THAT DELIVERS THE GREATEST TORQUE CAPACITY FOR ITS SIZE AND WEIGHT —*THAT'S FORMSPRAG.*

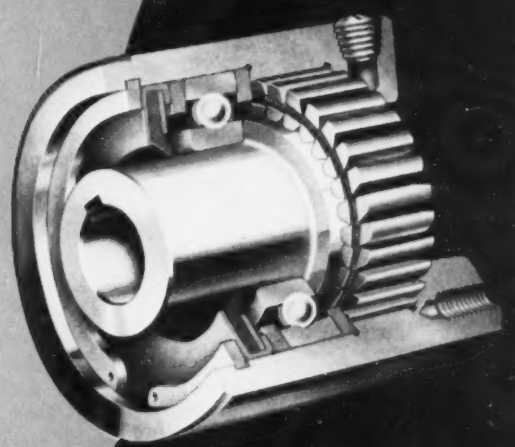




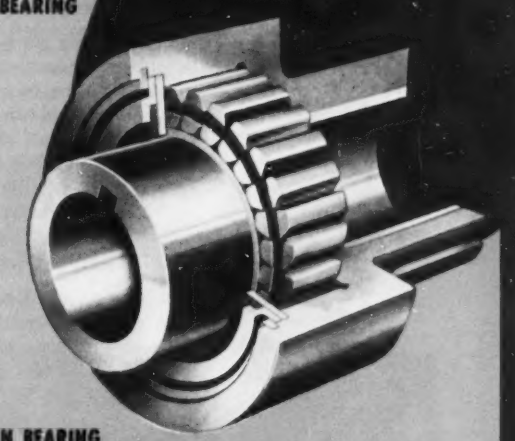
The infinite number of gripping positions available through sprag action makes possible this and other exclusive performance features like instantaneous operation with no backlash; internal simplicity; long life.



ALL PURPOSE BALL BEARING



SPECIAL PURPOSE BALL BEARING



PLAIN BEARING

Let Formsprag know today the performance you expect, the shaft size, the capacity, etc. If you don't have information on Formsprag clutches, send for it today with the coupon at right.

DISTRIBUTORS IN PRINCIPAL CITIES

Your inquiries about Balansprag and Cagedsprag Over-Running Clutches are welcomed by the Formsprag Company.

FORMSPRAG COMPANY
23609 Hoover Road, Van Dyke, Mich.

Send the Formsprag Folder to:

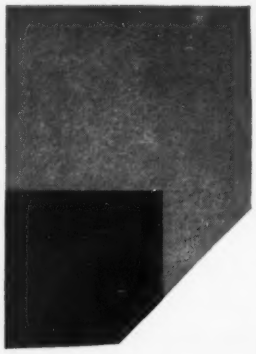
NAME _____

TITLE _____

COMPANY _____

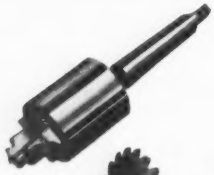
ADDRESS _____

_____



for Special Service on Carbide "Specials"

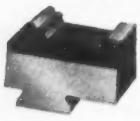
GORHAM



GORHAM

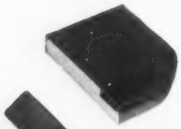
GORHAM

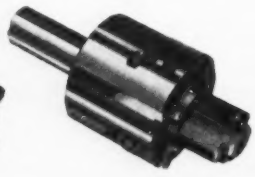
When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.



He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.





Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
Jarvis, Chas. L., Co., Middletown, Conn.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Thor Power Tool Co., Aurora, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob Bros., Grafton, Wis.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Bellows Co., 230 W. Market St., Akron, Ohio.
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meriden, Conn.

FINISHES FOR MACHINES AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis 7, Ind.

FLEXIBLE COUPLINGS
See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT
Jarvis, Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGING (Upsetting) MACHINES
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.

(*Continued on page* 416)

For more information on products advertised, use Inquiry Card, page 261

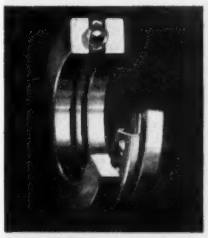
B SERIES • Light duty, one direction ball thrust bearing. Flat seat. Flat races. Bronze ball retainer . . . 38 sizes ½" to 3½" I.D.

C SERIES • Light duty, one direction ball thrust bearing. Flat seat. Flat races. Pressed steel retainer . . . 16 sizes ½" to 1⅞" I.D.

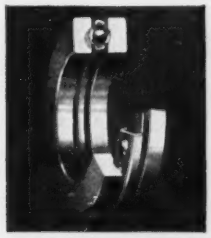
F SERIES • Light duty, one direction thrust bearing. Flat seat. Grooved races. Pressed steel retainer . . . 43 sizes ½" to 3½" I.D.

G SERIES • Medium duty ball thrust bearing. Grooved races. Pressed steel or bronze (large sizes) retainer . . . 76 sizes ½" to 7⅜" I.D.

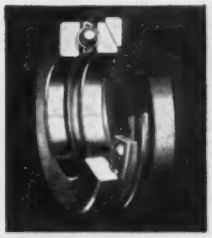
E SERIES • Medium duty ball thrust bearing. Banded. Flat seat. Grooved races. Full complement of balls . . . 40 sizes ½" to 3½" I.D.



1000 SERIES • Light duty ball thrust bearing. Flat seat. Grooved races. Pressed steel retainer. Metric standard . . . 26 sizes 10 to 125 mm. I.D.



1100 SERIES • Medium duty ball thrust bearing. Grooved races. Pressed steel or bronze (large sizes) retainer . . . 23 metric sizes 10 to 140 mm. I.D.



1400 SERIES • Medium duty. Grooved races. Spherical seat. Pressed steel or bronze (large sizes) retainer . . . 23 metric sizes 10 to 140 mm. I.D.

W SERIES • Case hardened and ground flat washers for various Thrust and Spacer applications. Slip fit. 38 sizes ½" to 3½" I.D.

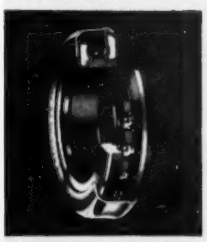
[illegible] TRIES • Ball thrust [illegible]ainer. One piece, [illegible]ssed steel, channel [illegible]pe cage . . . 79 inch sizes [illegible].266" to 4.232" I.D.

Just Name Your Need

Whatever mechanized equipment you make or use—whether it is large, small, rugged, fragile, heavy or light—whether it must operate at high speed, low speed, under water, in acid or under extreme temperature or dust conditions, it will do its job better, more efficiently and more economically if bearing equipped. If it is equipment that lends itself to bearing applications of the thrust type—Aetna has the answer or can come up with it pronto. 37 years of thrust bearing know-how assures this. Inquiries invited. No obligation. Aetna Ball and Roller Bearing Company, 4600 Schubert Ave., Chicago 39, Illinois.

Aetna

Precision Bearings and Parts for Every Branch of Industry



CLUTCH BEARINGS • Ball thrust clutch release bearing. Banded. Pre-lubricated. T-type, oil impregnated bronze retainer assures concentricity and smooth, quiet, long-life performance.

SPECIAL BEARINGS • Facilities for sizes up to 38" O.D. Counsel that brings you the expert technical aid that has ticked many of industry's toughest bearing application problems.

PRECISION PARTS • Aetna is versatile—can mass-produce vital parts in almost limitless sizes and shapes—to your most exacting metallurgical, tolerance and finish specifications.

Write **for latest catalog. Contains specifications on Aetna's complete line—vital technical reference data on bearing selection, load capacities, lubrication, care and maintenance.**

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For more information on products advertised, use Inquiry Card, page 261

for a tighter hold

Torrington Swaging Machines offer an ideal method of attaching ferrules and cable ends to wire or rod. Rapid hammer blows (4000 a minute) tighten the ferrule quickly around the rod – producing a bond that withstands as much tensile strain as the inner member alone.

"The Torrington Swaging Machine" tells you how to do a better job of shaping many metal parts, and save money, too. It also describes the complete line of Torrington machines. Write for your free copy...today!

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Swager Department
558 Field Street • Torrington, Conn.
Makers of
TORRINGTON NEEDLE BEARINGS

FORMING AND BENDING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif. (Stretch-Wrap).
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES

Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FORMING TOOLS or Tool Blanks

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded

Mahon, R. H. Co., Detroit 34, Mich.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 418)

For more information on products advertised, use Inquiry Card, page 261

*REO DESIGN ENGINEERS SAID...

TOUGH JOB?

WE'LL SPECIFY

STRESSPROOF®

SEVERELY COLD-WORKED, FURNACE-TREATED STEEL BARS

AGAIN!

Reo Motors, Lansing, Mich., have again specified STRESSPROOF —this time for the power shaft on their new rotary lawn mower.

Another
Reo Lawn Mower
to Use STRESSPROOF

Reo engineers needed *top performance* from this new drive shaft . . . so they insisted on STRESSPROOF! They knew from years of successful experience with STRESSPROOF that it could take abuse. It had both the strength and wearability to stand up under the toughest service—and its excellent machinability was most welcome from a cost standpoint.

The alternative to STRESSPROOF would have been a heat-treated part, with the attendant cleaning, straightening, and machining problems.

Only STRESSPROOF gives you a unique combination of four qualities *in-the-bar:* Strength, Wearability, Machinability, and Minimum Warpage. Yet it costs less than the other quality cold-finished steel bars.

STRESSPROOF makes a better part at lower cost! It is available in cold-drawn or ground and polished finish.

SEND FOR . . .
Free Engineering Bulletin,
"New Economies in the Use of Steel Bars"

La Salle STEEL CO.

Manufacturers of the Most Complete Line of Carbon and Alloy Cold-Finished and Ground and Polished Steel Bars in America.

La Salle Steel Co.
1428 150th Street
Hammond, Indiana

Please send me your STRESSPROOF Bulletin.

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Title _____
Company _____
Address _____
City _____ Zone _____ State _____

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago,
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GEAR BURNISHING MACHINES

Feilows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR FINISHING MACHINES

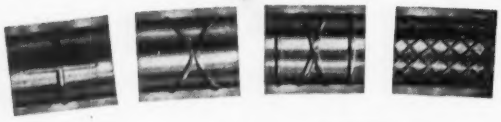
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17,
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

(*Continued on page* 420)

High Speed
CONTINUOUS OIL GROOVING



500
PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4½" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

WICACO

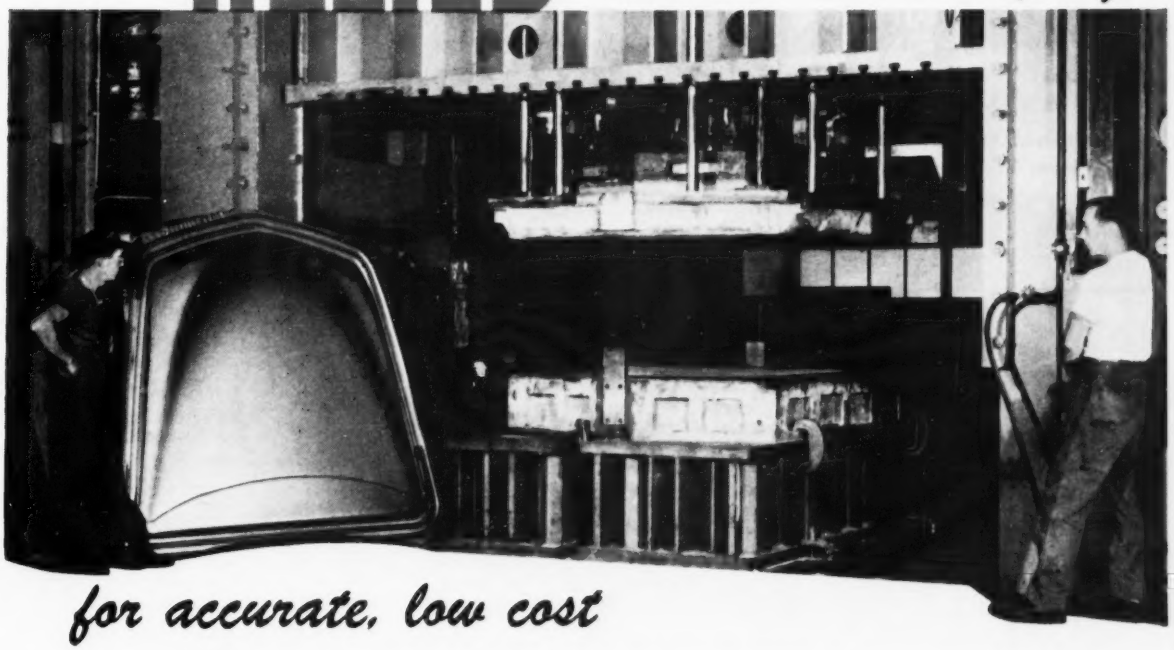
SINCE 1868

THE WICACO MACHINE CORPORATION

WAYNE JUNCTION PHILADELPHIA 44, PA.

For more information on products advertised, use Inquiry Card, page 261

ALLIED *builds the dies... delivers the stampings*



for accurate, low cost

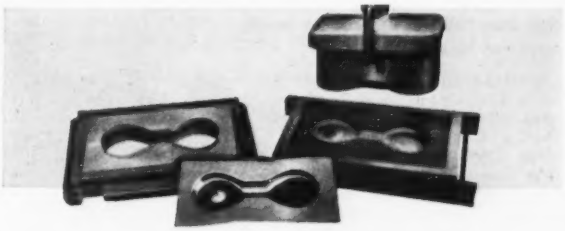
PROTOTYPE SHEET METAL PARTS

You can center *complete* responsibility with Allied's Allite Division for sheet metal stampings for prototype production . . . and save time, money and uncertainty by doing so.

For prototype production, Allied is thoroughly equipped to produce either plastic or Allite (zinc alloy) dies, depending on the physical or volume requirements of the parts. Upon completion of the draw dies, the necessary number of stampings are then produced on Allied presses and trimmed, flanged and pierced by hand and delivered ready for assembly.

When desired, the prototype dies can serve as the basis for development of production draw dies. With approval of the prototype parts, the production dies can then be built without delay or error—the true die conditions having been proved in the original, inexpensive prototype dies.

We'll be glad to show you how this unique, all-inclusive service can fit your prototype requirements. Your inquiry will receive prompt attention.



PRECISION · EXPERIENCE · DEPENDABILITY
ALLIED PRODUCTS CORPORATION

Other Allied Products { SPECIAL COLD FORGED PARTS • STANDARD CAP SCREWS • HARDENED AND PRECISION GROUND PARTS • R-B INTERCHANGEABLE PUNCHES AND DIES

ALLIED PRODUCTS CORPORATION

Dept. D-15 12619 Burt Road - Detroit 23, Michigan

PLANT 1
Detroit, Mich.

PLANT 2
Detroit, Mich.

PLANT 3
Hillsdale, Mich.

PLANT 4
Hillsdale, Mich.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works Inc., 200 Lafayette St., New York 12, N. Y.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Franke Gear Works, Inc., 1924 W. Columbia Ave., Chicago 26, Ill.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Pittsburgh Gear Co., 2700 Smallman St., Pittsburgh, Pa.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Amgears, Inc., 6633 W. 65th St., Chicago 38.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Pittsburgh Gear Co., 2700 Smallman St., Pittsburgh, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa

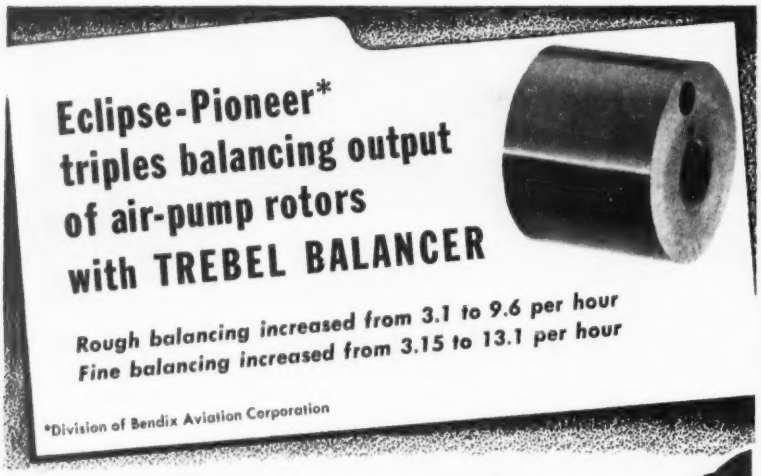
GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.

(*Continued on page 422*)



Eclipse-Pioneer* triples balancing output of air-pump rotors with TREBEL BALANCER

Rough balancing increased from 3.1 to 9.6 per hour
Fine balancing increased from 3.15 to 13.1 per hour

*Division of Bendix Aviation Corporation

Locate unbalance in your rotating parts this fast, simple way

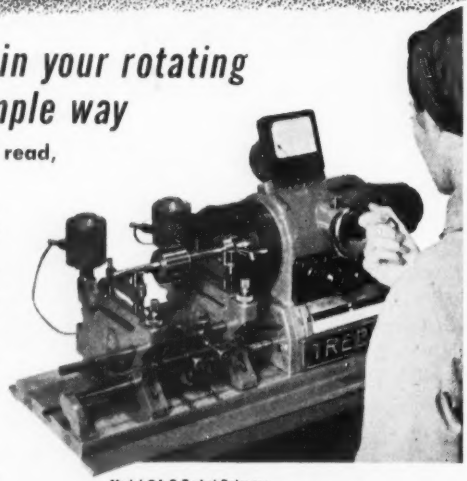
Takes less than a minute to read, 2 minutes to set up.

No special skills are needed to detect the *unbalance* that causes *vibration* in rotating parts . . . when you use the TREBEL DYNAMIC BALANCER.

The unique TREBEL dynamic balancing principle applies a variable counter-vibration to counteract unbalance vibration. Direct readings in ounce-inches give the *amount* of unbalance without further calibration; readings in degrees show *location* of unbalance.

That's why so many leading plants use the TREBEL.

Write for Catalog "E" or see a demonstration in your own plant.



Model 2 b 5 Trebel Balancer
Weight capacity 2½ oz. to 4½ lbs.
Max. work diameter 7"; length 18"
Accurate within .000025" displacement of center of gravity
Other Trebel models for work up to 22,000 lbs. and 98½" OD.

KURT ORBAN COMPANY, INC.

205 East 42nd St., N. Y. 17 • Offices in Cleveland, Detroit, Los Angeles, San Francisco, Houston
Canadian sales by European Machinery Ltd., 11 King St. West, Toronto, Canada.

For more information on products advertised, use Inquiry Card, page 261

OK MILLING CUTTERS IN THE AIRCRAFT INDUSTRY—NO. 7

OK carbide cutter

facemills push-rod faces of cylinder head for world's most powerful piston aircraft engine

OK CARBIDE CUTTER, ON CINCINNATI VERTICAL FINISH-MILLS RIGHT ANGLES OF INTAKE AND EXHAUST PUSH ROD FACES, OF PRATT & WHITNEY AIRCRAFT WASP MAJOR ENGINE CLIMB-MILLING ONE AND CONVENTIONAL-MILLING THE OTHER

THE close tolerances specified by the aircraft industry are a challenge to the "world's most modern milling cutters" and the "world's most modern milling machines."

The picture shows one of thousands of milling machine operations. Note the tilting fixture which makes possible face and periphery milling, of both sides of the cylinder head.

OK carbide milling cutters are widely used in the aircraft industry because they have the necessary stamina . . . *more beef* in the body, pack *more blades* for finishing cuts, *heavier blades* for *roughing* cuts. They put more finished pieces on the floor, day after day.

Blades are simple wedge-shaped blocks. (The wedge is world's strongest mechanical device). Blades once set, cannot move. Mated serrations prevent tipping and slipping, provide a scale for blade advancement to compensate for wear, reduce grinding to less than .005" per blade on cutters in which the fine adjustment feature is incorporated. No locks, blocks, screws, pins or gibs are needed.

Write for OK Tool Catalogs

"MODERN MILLING CUTTERS FOR MODERN MILLING MACHINES"
"AMERICA'S FIRST SYSTEM OF SINGLE POINT TOOLS"

TWO COMPONENTS—
BODY AND BLADES
SIMPLE . . .
STRONG . . .
SUFFICIENT . . .

OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY, INC. Milford 6, New Hampshire

WITH FOUR TIMES THE SPEED; ONE FOURTH THE DISTORTION

"Manual Lincolnweld's" high-current-density welding could solve your fabricating problem

THE PROBLEM: To fabricate a table 46" square calls for welding 1" plate, ribbed with 2" by ½" and 4" by ½" bar and channels from 3/16" plate. The hub is hot rolled bar and center ring is 6" by ¾" stock. With hand welding, distortion averaged ½" to 3/8".

LINCOLN'S ANSWER: High-current-density welding in agglomerated flux with "Manual Lincolnweld" at speeds 4 times that possible with hand welding using coated electrodes. Speed on ¼" fillets increased from 7" to 28" per minute.

THE RESULTS: Concentrating high welding currents on 5/64" electrode gives full penetration in one pass. Distortion is reduced from 3/8" to only 1/8". Welds are smooth, uniform and essentially self-cleaning, saving manhours in cleaning and finishing to cut shop production costs still further.

Fig. 1. Simpler to Fabricate. Positioner table is fillet welded with "Manual Lincolnweld's" hidden-arc welding in granular flux. Welding speed for ¼" fillet weld is 28" per minute. Photo courtesy Worthington Corporation, Plainfield, N. J.

Fig. 2. Rugged Welded-Steel Table is fabricated for less cost. Welds are smooth, uniform, ductile. Distortion is cut 75% over hand welding.

WHAT'S YOUR PROBLEM? Complete Automatic Service — machines, electrodes, engineering—is available at one source . . . Lincoln. Your nearest Lincoln representative can demonstrate the latest developments in hidden-arc welding to speed your production and cut shop costs.

Bulletins on boosting production efficiency with "Manual Lincolnweld" are available by writing on your letterhead. Ask for Bulletin 1303. Dept. 1209.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND 17, OHIO
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Centerless

Van Norman Co., Springfield, Mass.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Bellows Co., 230 W. Market St., Akron, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besly-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

(*Continued on page 426*)

HANSELL-ELCOCK for Structure Controlled GRAY IRON CASTINGS

You get all these qualities at Hansell-Elcock—whether you buy in jobbing lots or production quantities. When you want castings from 50 lbs. to 20 tons, call us at CA 5-7000 (Chicago).

Manufactures of Gray Iron Castings and Fabricators of Structural Steel for 65 years

HANSELL-ELCOCK COMPANY
SERVING INDUSTRY SINCE 1888
485 W. 23rd PLACE • CHICAGO 16, ILL.

For more information on products advertised, use Inquiry Card, page 261

here it is!

new HYDRAULIC THREAD MILLING MACHINE

Check These Outstanding Features

- Hydraulic-driven cutter and work spindles.
- Rapid traverse carriage.
- Variable cutter speeds up to 3000 r.p.m.
- Permits use of carbide cutters where applicable.
- Lead cams and cross-feed cams.
- Semi-automatic operating cycles.

. . . a new *Hanson* process that permits maximum operation efficiency under the widest possible range of conditions.

Simply by turning a dial, *even during operation,* operator can adjust machine to *coordinate* all machining elements.

As a result, production rates can be increased and maintained, and cutter life can be considerably increased.

Manufactured in the following capacities: 4" x 9", 8" x 16", 10" x 24", 15" x 30". Longer beds and larger swings to suit customers' requirements.

If you have a threading problem, the "Hanson Process" will offer you the most economical solution. Investigate today!

the HANSON
Threading Processes Offer Complete Coordinated Responsibility
The Machine Tools
The Cutting Tools
The Measuring Gages

Engineered, Produced and Sold by the
HANSON-WHITNEY DIVISION of the WHITNEY CHAIN CO.
160 Bartholomew Avenue Hartford 2, Connecticut, U. S. A.

THREAD MILLING MACHINES • SMALL TOOLS • GAGES

10HW88A

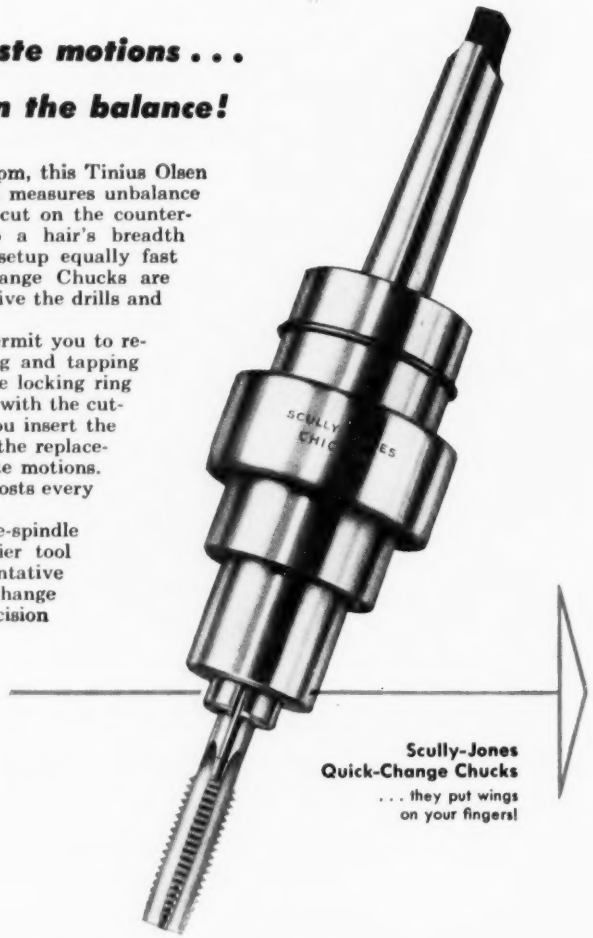
SCULLY JONES CHUCKS speed tool

Quick-Change Chucks eliminate waste motions . . . costs and crankshafts hang in the balance!

Rotating the part at 600 rpm, this Tinius Olsen machine automatically locates and measures unbalance . . . sets drills for correct depth of cut on the counterweights . . . balances crankshafts to a hair's breadth without human handling! Making setup equally fast and efficient, Scully-Jones Quick-Change Chucks are used on each of the four spindles to drive the drills and simplify tool changes.

Scully-Jones Quick-Change Chucks permit you to replace tools for sequence drilling, reaming and tapping operations *in jig time.* You merely lift the locking ring *without stopping the machine* and the collet with the cutting tool drops out. In the next motion you insert the new collet, let the ring fall into place, and the replacement tool is ready to cut. There are no waste motions. Idle machine time is at a new low. You save costs every time you change tools!

Get multiple-spindle results from your single-spindle drill presses and radial drills with faster, easier tool changes. Ask your nearby Scully-Jones Representative or stocking distributor for full details on Quick-Change Chucks and the complete line of Scully-Jones "Precision Holding" Tools!



Scully-Jones Quick-Change Chucks
. . . they put wings on your fingers!

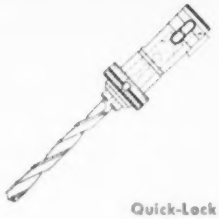
ACCURATE RESULTS ASSURED—the locking ring on the chuck serves double duty. It holds the collet firmly in position and furnishes a positive drive to the two balls which form the driving mechanism. There's no vibration or slipping . . . no sacrifice in quality!

LONG-LIFE PERFORMANCE—maintenance and replacement costs are low because Scully-Jones Chucks are heat treated and ground to assure long-life performance.

THERE'S A SCULLY-JONES PRECISION TOOL FOR EVERY HOLDING OR DRIVING NEED

Drill Chucks
For driving straight shank tools. Permit use of jobber length drills, saving extra cost of taper shank drills.

Tap Chucks
Save costly setup time. Eliminate bell-mouthed and oversized tapped holes. True collet action on shank of tap.



Quick-Lock Adapters
Permit accurate adjustments in cluster of spindles. End guesswork on fine adjustments. Speed tool changes.

Close-Center Tap Drivers
For tapping holes close together or near shoulder of work. Collet action minimizes strain, saves taps.

changes on Tinius Olsen balancer

New high-speed balancer, manufactured by Tinius Olsen Testing Machine Co., Willow Grove, Pa., dynamically balances crankshafts, drills to correct unbalance to 0.3 ounce-inch. Drilling heads are "factory-equipped" with Scully-Jones Quick-Change Tool Chucks and Quick-Lock Adjustable Adapters.

SCULLY JONES

Precision Holding

FOR HOLDING PRECISION

Scully-Jones and Company, 1906 South Rockwell Street, Chicago 8, Illinois

MORE FACTS—Send for free catalog describing Scully-Jones "Precision Holding" Tools. Paste coupon to letterhead or post card and mail today.

Gentlemen: I'm interested in learning more about Scully-Jones Tools.

- ☐ Please send Bulletin No. 3-50 describing Quick-Change Chucks.
- ☐ Send catalog on your complete line.

Name_____

Company_____

Address_____

City_____ State_____

For more information on products advertised, use Inquiry Card, page 261

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

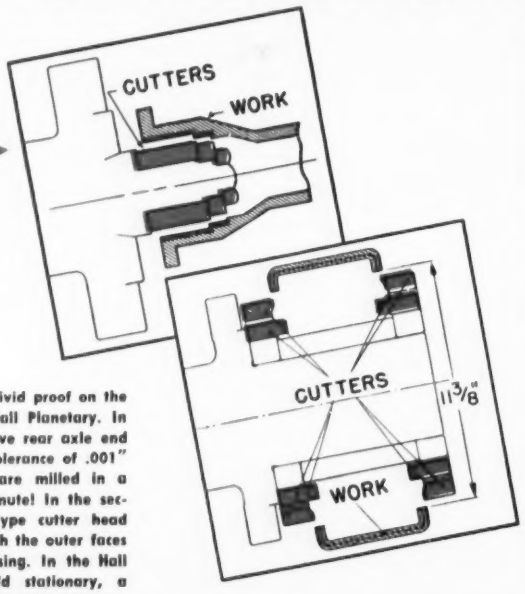
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Do All Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

automotive production jobs on the HALL PLANETARY!

Speed operations on hard-to-handle parts.



Here are two jobs that are vivid proof on the unique advantages of the Hall Planetary. In the job at the top, automotive rear axle end holes are planamilled to a tolerance of .001" plus or minus. Both ends are milled in a floor-to-floor time of one minute! In the second job, a unique button-type cutter head simultaneously form-mills both the outer faces of the banjo rear axle housing. In the Hall Planetary the work is held stationary, a feature which simplifies the handling of parts (like this rear axle housing) which cannot be rotated. And, because the work fixture is secured to the head, accuracy and rigidity are assured. Rotating eccentric containers produce the exclusive planetary movement. — The spindle on which the cutters are mounted rotates within these eccentrics and moves in a circular arc from the center, beginning to cut near the extreme of the eccentric. The cutters then move around the circumference of the work, completing the cuts and automatically returning to center in one revolution.

THE HALL PLANETARY COMPANY
Fox Street and Abbotsford Ave., Philadelphia 29, Pa.

GRINDING MACHINES, Chucking

Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDER MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Drill

Blake, Edward, Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co 614G N. Lexington Ave., Pittsburgh 8, Pa
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Besly-Welles Corp., Beloit, Wis.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment.

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES, For Sharpening Cutters, Reamers, Hobs, Etc.

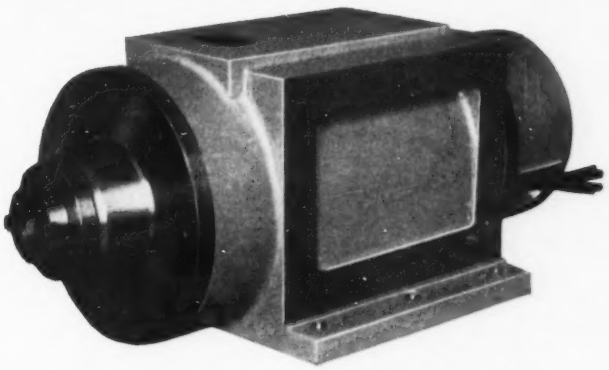
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows' Gear Shaper Co., 78 River St., Springfield, Vt.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.

(*Continued on page* 428)

For High Speed Milling on Non-Ferrous Metals

Specify **POPE** HIGH FREQUENCY HEAVY DUTY PRECISION SPINDLES

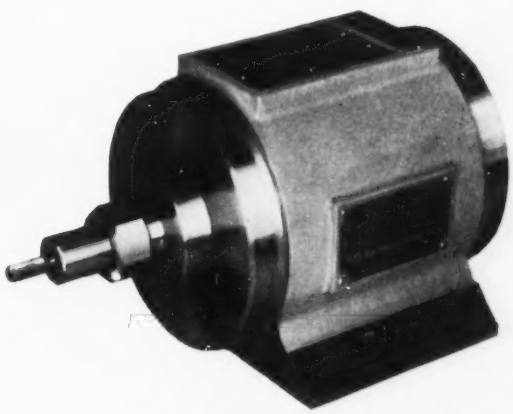
These Heavy Duty, High Speed Milling Spindles can be furnished in a wide variety of horsepowers and speeds, ranging from ½ h.p. to 100 h.p. and from 3600 r.p.m. to 60,000 r.p.m. They are unequalled for long life, trouble-free operation and rugged ability to cut metal fast.



20 h.p. at 7200 r.p.m.
40 h.p. at 14,400 r.p.m.

These Spindles are arranged to operate in horizontal, vertical or angular position, whichever you specify.

15 h.p. at 14,400 r.p.m.



2 pole — 4 pole motor
¾ h.p. at 12000 r.p.m.
½ h.p. at 6000 r.p.m.
1 h.p. at 18000 r.p.m.
1½ h.p. at 36000 r.p.m.

POPE designs and builds *special* High Frequency Spindles for a great range of applications. For recommendations and quotations, let us have your specifications.

No. 97

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

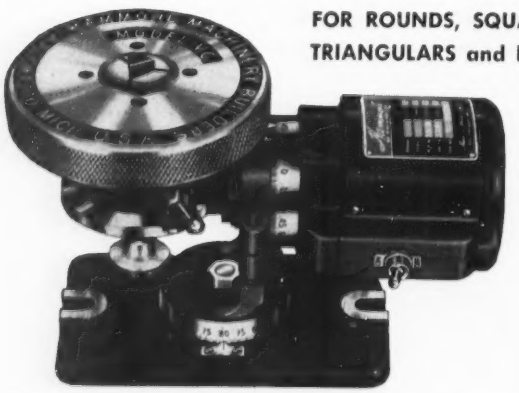
GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.

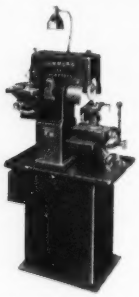
Hammond OF KALAMAZOO
GOOD MACHINERY SINCE '82

FAST ACCURATE GRINDING
of SOLID CARBIDE INSERT TOOLS

FOR ROUNDS, SQUARES,
TRIANGULARS and RECTANGULARS



MODEL VC, Style M Motorized Solid Carbide Insert Grinding Fixture. Style H, without motor also available. Write for Bulletin No. 235.



HAMMOND MODEL CB-77 CHIP BREAKER AND DIAMOND FINISHING GRINDER can be supplied with both the standard Any Angle Vise and the Model VC Solid Carbide Insert Grinding Fixture.

THE Hammond Solid Carbide Insert Grinding Fixture pays for itself in a few weeks. Offers a fast, economical and accurate means of grinding chip breaker grooves in round, square, triangular and rectangular shapes and for rough and finish grinding of dull and damaged carbide inserts. Motorized Style M with lug base can be mounted on most tool and surface grinders and Hammond CB-76, CB-77 and CB-77W Chip Breaker Grinders.

BUILDERS OF AMERICA'S MOST COMPLETE LINE OF CARBIDE TOOL GRINDERS

Hammond Machinery Builders INC.

1619 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Mattison Machine Works, Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Radial, Ball Race, Etc.

Besly-Welles Corp., Beloit, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radius, Link

Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Ring Wheel

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6 Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

(*Continued on page* 430)

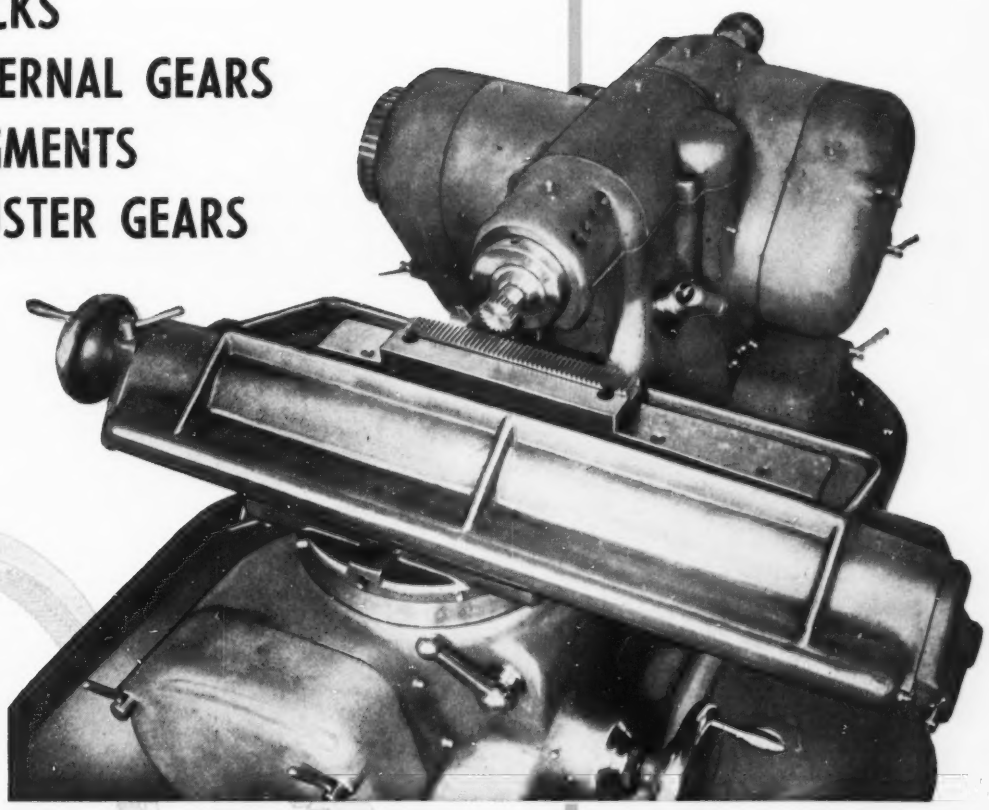
For more information on products advertised, use Inquiry Card, page 261

MIKRON | *fine pitch*

RACK & GEAR CUTTER NO. 134—

Another machine in the MIKRON line—Controlled Accuracy. High Finish, Ease of Set-Up.

- **RACKS**
- **INTERNAL GEARS**
- **SEGMENTS**
- **CLUSTER GEARS**



THE precision cutter shapes as it generates tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.

WORK PIECE CAPACITY

RACKS: (Straight or Skew) to 36″ long x 1″ wide.
SEGMENTS & CLUSTERS: to 3½″ dia. x 1″ wide.
INTERNAL GEARS: to 4″ dia. x 1″ wide.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

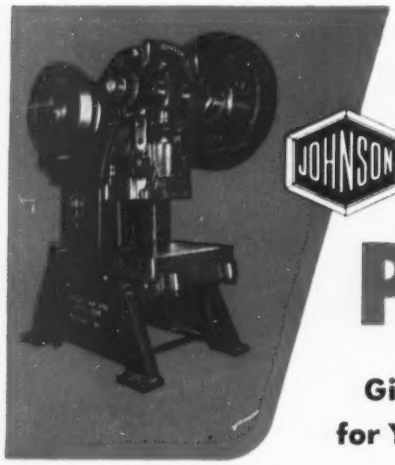
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.



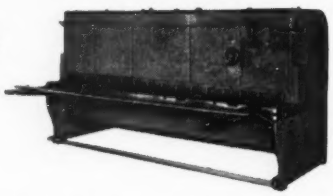
Bonus Built
JOHNSON
POWER PRESSES

Gives You More Service for Your Production Dollar

- Non-Repeating Safety Clutch
- Double Spring Activated
- Unusual Versatility
- Larger Die Space
- Ample Power
- Adaptable to Metals, Plastic, etc.

WRITE FOR SPECIFICATION BULLETIN No. 53

for SPEED POWER ACCURACY
the HYDRA-SHEAR



Will increase your production to a new high. Will shear mild steel up to 10 gauge in three lengths: 6, 8 and 10 feet. Less curl and burring. No gears or clutch.

Johnson MACHINE and PRESS CORP.
620 WEST INDIANA AVENUE • ELKHART, INDIANA

Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Bay State Abrasive Products Co., Westboro, Mass.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati, Ohio.
Gardner Machine Co., (Surface Grinder) 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HARDENING EQUIPMENT

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDENING, Surface Treatment

Electrolizing Corp., 1505 East End Ave., Chicago Heights, Ill.

HARDNESS TESTING INSTRUMENTS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

(*Continued on page* 434)

For more information on products advertised, use Inquiry Card, page 261

Now for the first time in a

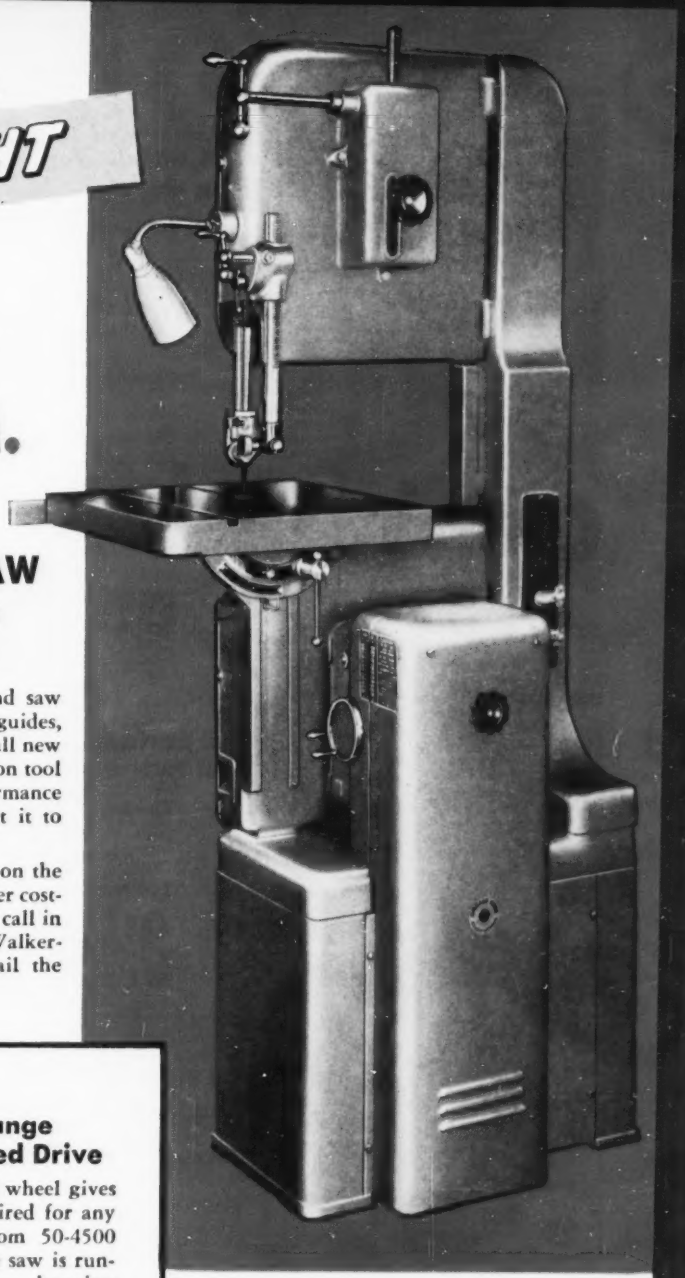
LIGHT-HEAVYWEIGHT

SPEEDS FROM 50-4500 S. F. M.

with the new

WALKER-TURNER 16" BAND SAW

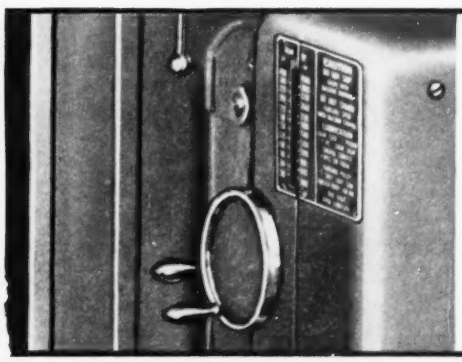
You just dial the exact speed you want for a specific job — *while the machine is running.*



Newest of the Walker-Turner *light-heavyweights*, this 16" Band Saw features a Variable Speed Drive. Handles hundreds of cutting jobs — from tool steel to plastics — requiring varying rates of blade speeds. Infinitely variable speeds — from 50-4500 S.F.M. — are controlled by a hand wheel. No time "lost" changing belts or pulleys. Blade speeds are shown on a graduated scale.

In addition to the new Variable Speed Drive this new band saw features improved saw guides, quick change tires and an all new base. It's a versatile precision tool designed to set new performance records in your plant. Put it to work . . . and save.

For complete information on the new 16" Band Saw and other cost-cutting *light-heavyweights* call in your local factory-trained Walker-Turner distributor, or mail the coupon.



Quick-change Variable Speed Drive

A turn of the hand wheel gives the exact speed desired for any cutting job — from 50-4500 S.F.M. — while the saw is running. No "lost" time changing belts or pulleys.

Features that give you the most for your machine dollar!

CAPACITY: Blade to frame 16". Upper guide to table, max. 8".

SPEEDS: Infinitely variable, 50-4500 S.F.M.

FRAME: Three-piece frame and body construction for greater rigidity, accuracy and smoother operation.

BEARINGS: 6 Heavy duty precision ball bearings.

WHEELS: Dynamically balanced, rubber faced. Quick change tires standard equipment.

TABLE: Cast iron 18" x 17", carefully machined with $\frac{3}{4}$" x $\frac{3}{8}$" miter gauge slot. Tilts to 45°.

GUIDES: Improved upper and lower leaf-type with ball-bearing rollers.

GUARDS: Cast aluminum doors cover wheels. Blade fully protected.

ACCESSORIES AVAILABLE:

AUTOMATIC POWER FEED: For cutting straight or irregular pieces. Unique clutch mechanism prevents overloading, prolongs blade life.

WELDING UNIT: For blades to $\frac{1}{2}$" wide. Available for operation on 110 or 220 volt A.C. Self contained grinder for removing flash.

SOLD THROUGH *FACTORY-TRAINED* INDUSTRIAL DISTRIBUTORS

WALKER-TURNER

• DIVISION •

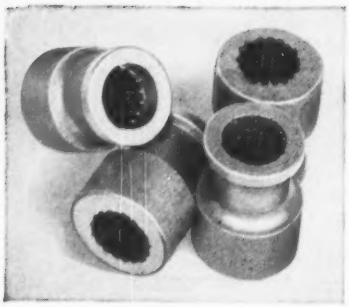
KEARNEY AND TRECKER CORPORATION

PLAINFIELD, N. J.

Drill Presses — Hand and Power Feed • Radial Drills
Wood and Metal Cutting Band Saws • Tilting Arbor Saws
Radial Saws • Jig Saws • Lathes • Spindle Shapers
Jointers • Belt and Disc Surfacers • Flexible Shaft Machines

-----Use this space-------

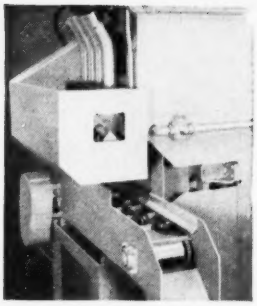
To send for full details and specifications
Walker-Turner Division, Kearney & Trecker Corp.
Dept. M 11, Plainfield, N. J.



13,600 Splines/hour on one machine

The part: Steel forgings in which 17 internal splines of 1½" O.D. are to be broached.

The machine: A Colonial 20-ton 48" stroke Pull-up with multiple loading chutes, positioning shuttle and automatic ejector conveyor.

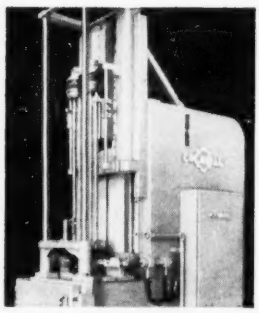


Colonials help you do MORE JOBS on FEWER MACHINES

12 Surfaces, 8 Bores on two machines

The part: Tank track forging requiring finishing of 6 flat surfaces and 4 bores in thin webs, broached two at a time.

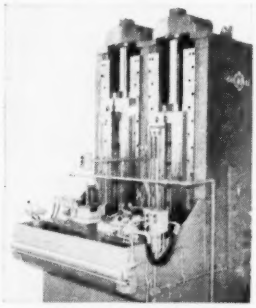
The machines: Colonial 25-ton Dual Ram for flat surfaces, Colonial Pull-down with automatic spreaders to support the part while broaching bores.

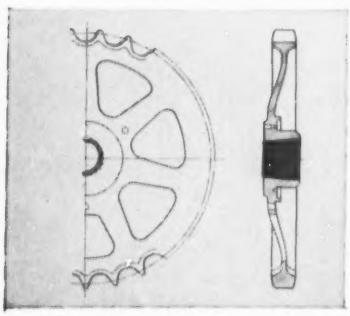


7 Surfaces, 4 Operations on two machines

The part: Tank track center guide to be completely machined as shown.

The machines: Two 25-ton Dual Ram machines perform all operations, produce one guide for each machine cycle.

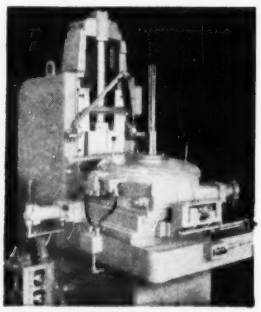




Large Tapered Splines Broached in One Setup

The parts: Tractor wheel hubs, (several sizes).

The machine: Colonial 15-ton Pull-down equipped with special angular short-shuttle table, and automatic index.



PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

For further information on the examples shown here, ask for Broaching News, Volume XIV, No. 1

SURFACE BROACHING IS BOOMING

Figures recently released by the Department of Commerce show that there were a total of 637 Surface Broaching Machines shipped by American manufacturers in 1952 as against only 245 in 1951. This tremendous upsurge in surface broaching is a clear indication of its tremendous importance in the high productive capacity of American manufacturers.

Back of this upsurge in surface broaching stand years of development and improvement in broaching machines, broaches, fixtures, and automatic handling of broached parts.

Colonial Broach Company has had an important part in this development and constant improvement for the last thirty-five years. Examples of this development are: High Speed Steel Broaches for increased life and accuracy, Carbide Inserts for high speed surface broaching, Hydraulic Broaching Machines, Automatic Broach and Automatic Parts Handling, Automatic Shuttling Fixtures, Hydraulic-Electric Controls and Automatic Broaching Cycles.

One of the most important contributions of Colonial Broach is "Unified Broaching." With single responsibility for design, manufacture and installation of complete Broaching Equipment, it brings to the production manufacturer an all-over consideration of his problems. This "Unified Broaching" includes Broaching Machines, Broaches, Fixtures, and Automation, all by Colonial Broach Company. Automatic gaging may also be included.

By working out a unified team of broaches, machines, fixtures and automation — properly installed in relation to their use—lost time and inefficiency are reduced. The parts are quickly handled, accurately machined and properly finished with fewer operations in a smaller area of your shop. Production zooms upward when responsibility is centralized in hands that have experience, imagination and competence in complete Broaching Installations.

"Unified Broaching" is being applied to both external and internal applications for broaching materials of all types, sizes and contours. Harmonious design of all the component parts of a complete Colonial "Unified Broaching" Installation starts with part print, material specifications, and production requirements of the part desired. Send this information on your jobs to Colonial Broach Company, Detroit, and request a quotation on a "Unified Broaching" Installation for your plant.

Read "Broaching News" for latest developments in broaching. We will be glad to see you get it regularly if you will drop us a line on your company letterhead.

"A BUSHING IS a Bushing"

"After all, a bushing is a bushing." To Colonial Bushings, Fraser, Michigan, that oft-repeated phrase is an invitation to explain why a Colonial drill jig bushing is a thing apart from "run of the mine" bushings.

Qualities like a steel that gives consistently long life in bushing service, I.D. concentric with O.D. within 0.0003", fine finish, dependable accuracy on all dimensions, shipment from stock, are some of the points mentioned. If the bin runs dry because of excessive demand for a particular standard size, the shop is set up to replenish this size in short order. Parcel Post hastens delivery of the bushings to the user. And all through the organization, there is a genuine willingness to serve the customer.

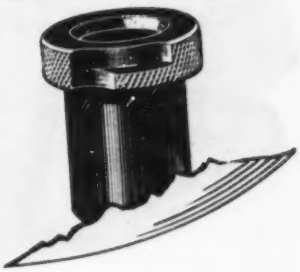
Through these qualities and practices, the demand for standard Colonial Drill Jig Bushings is constantly expanding.

Specials

The quality of these standard bushings in service plus the willingness of Colonial Bushings to serve the customer has been responsible for the increasing growth of another service to Colonial's customers—the production of special bushings.

Special bushings are made to the customer's print and specifications. These specials are quite often intricate, at other times only slightly different from the standard drill jig bushings. The flexibility of Colonials shop enables the production of these specials promptly and to the desired accuracies and specifications.

So whether the customer requires standard drill jig bushings that are a shade better, or specials to answer the needs for a particular problem, they are both available from Colonial Bushings, Inc., 31780 Groesbeck Highway, Fraser, Michigan. Ask for "Flip-A-Page" Catalog B-649 for Colonial Standard Drill Jig Bushings, or send prints for quotes on Colonial Specials.



HEAT-TREATING EQUIPMENT
Ipsen Industries, Inc., 536 N. Madison, Rockford, Ill.

HOBBING MACHINES
See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

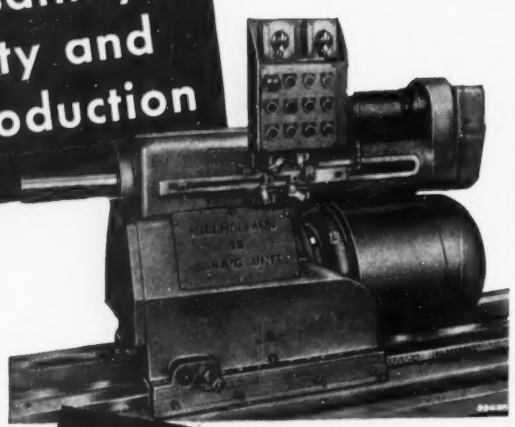
HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Shear Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

For Versatility Flexibility and High Production



MILLHOLLAND'S New AUTOMATIC BORING UNIT

Here's a new fixed center Horizontal Boring Mill unit that quickly gives you toolroom accuracy and production speeds—plus versatility!

Specially designed for short and medium run jobs, a single Millholland Automatic Boring Unit can be used for a variety of jobs, and one or more units can be mounted on a bed to perform a wide range of operations. Automatic operation replaces manual lever shifts, giving a complete automatic feed cycle. Hydraulic feeds are infinitely adjustable.

The body is heavily proportioned throughout for maximum rigidity. The hardened steel alloy spindle reciprocates thru hardened steel bushings mounted in the sleeve. The sleeve is contained in two precision Timken bearings.

SPECIFICATIONS

Horsepower	5 to 10	Diameter of spindle	3"
Spindle speeds by pick-off gears	33 to 500 rpm	Morse taper of spindle	No. 5
		Length of stroke	10"

Send for Catalog M-1111

Get more information about this new Millholland Automatic Boring Unit. Let us show you how efficiently they can be applied to many of your horizontal boring mill operations.

W. K. MILLHOLLAND MACHINERY COMPANY, INC.
6402 WESTFIELD BLVD.
INDIANAPOLIS 20, INDIANA

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

HONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HONING TOOLS AND FIXTURES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.

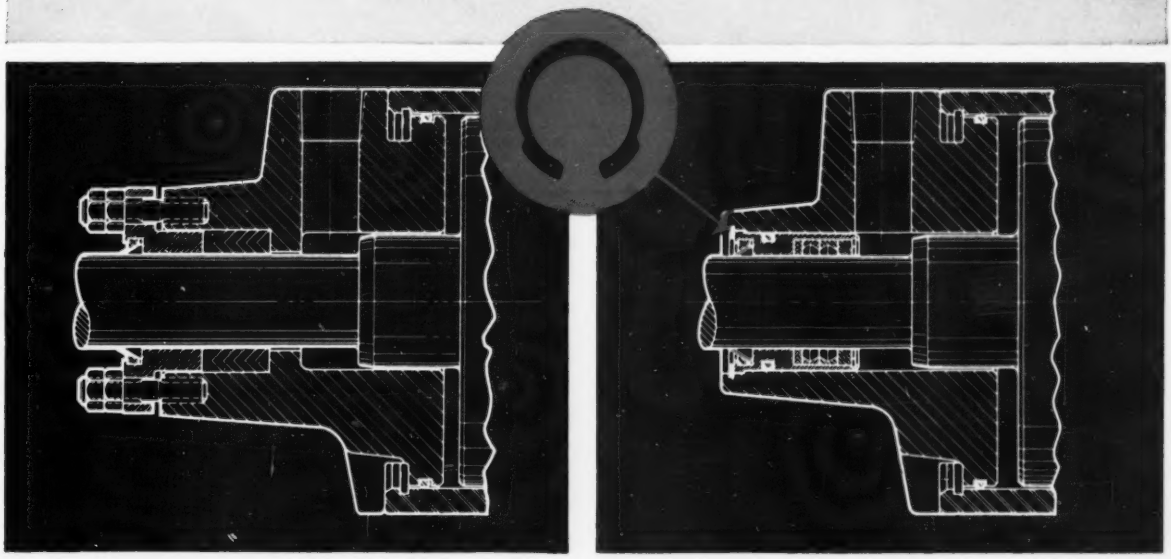
HYDRAULIC MACHINERY, Tools and equipment
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S, W.. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

HYDRAULIC POWER UNITS OR TOOL HEADS
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Bellows Co., 230 W. Market St., Akron, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.

(*Continued on page 436*)

For more information on products advertised, use Inquiry Card, page 261

Waldes Truarc Ring Saves $2.84 Per Unit, Cuts Labor-Time and Materials in Hydraulic Packing Unit



OLD STYLE stuffing box required skilled worker to install packing rings one at a time, then adjust packing glands by trial and error. Disassembly was equally difficult, time-consuming and costly.

NEW Monopak Cartridge is smaller, lighter, streamlined and installed with one Truarc Retaining Ring. Disassembly and reassembly with new cartridge takes unskilled worker just 1 minute.

Hydraulic Accessories Company of Van Dyke, Michigan, uses a single Waldes Truarc Inverted Ring (internal series 5008) to hold Monopak Cartridge in cylinder head.

New design eliminates costly machining and saves 2⅛ lbs. of material. Re-design with Waldes Truarc Retaining Ring reduces stuffing box diameter from 3½" to 2⅞", and reduces length from 5⅞" to 4⅜". Allows savings in assembly, adjusting and testing.

NEW DESIGN USING WALDES TRUARC RING PERMITTED THESE SAVINGS PER UNIT

MACHINE TIME SAVED:	
Chucking, facing and boring	$ .72
Drilling and tapping 3 holes	.18
Drilling and counterboring 3 holes	.12
Assembling, adjusting, testing	.90
MATERIAL SAVED:	
1½ lbs. cast iron	.30
½ lb. bronze	.23
3 studs	.36
3 nuts	.03
TOTAL	**$2.84**

Waldes Truarc Retaining Rings are precision-engineered . . . quick and easy to assemble and disassemble. Always circular to give a never-failing grip. They can be used over and over again. There's a Waldes Truarc Ring to answer every fastening problem.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

For precision internal grooving and undercutting . . . Waldes Truarc Grooving Tool.

SEND FOR NEW CATALOG ➧

WALDES

TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,416,052; 2,420,921; 2,420,341; 2,439,705; 2,441,949; 2,455,165; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,509,081 AND OTHER PATENTS PENDING

Waldes Kohinoor, Inc., 47-16 Austel Place, L.I.C. 1, N.Y.

Please send me the new Waldes Truarc Retaining Ring catalog. M115

(Please print)

Name.....

Title.....

Company.....

Business Address.....

City..... Zone..... State.....

★

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston, 35, Mass.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

INDEXING AND SPACING EQUIPMENT
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Bellows Co., 230 W. Market St., Akron, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

INDICATORS, Test
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT
General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INSPECTION INSTRUMENTS, Visual
American Cystoscope Makers Inc., 1241 Lafayette Ave., New York, N. Y.

INTENSIFIERS, Hydraulic
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Baldwin-Lima-Hamilton Corp., Philadelphia 42
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Northwestern Tool & Engrg. Co., 117 Hollier Dayton, Ohio.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E Nine Mile Rd., Detroit 20, Mich.

JOINTS
See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.
Morton Mfg. Co., Muskegon Heights, Mich.

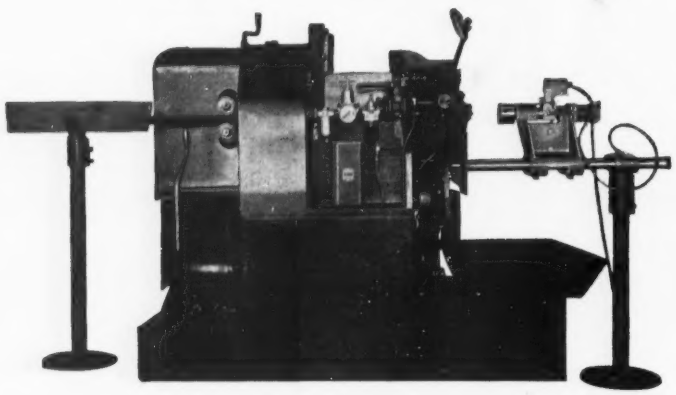
KNURL HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.

LAPPING MACHINES
Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.).

(*Continued on page* 438)

The NEW MODERN AUTOMATIC
CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing
This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled
This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing
This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

4" Threaded Studs

Cut and chamfered at one time—in 8 seconds—from 10 ft. length of stock already threaded. (¾" U. S. Standard.) Clean cut. Clean chamfer. Nuts start easily, with no extra finishing required.

WRITE FOR ILLUSTRATED CATALOG.

MODERN MACHINE TOOL CO.
Jackson, Michigan

INSERTS, Milling Cutter
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston, 35, Mass.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

INSPECTION MACHINES
Ames, B. C., Waltham 54, Mass.
Bellows Co., 230 W. Market St., Akron, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INSPECTION MACHINES, Optical
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Surface Finish
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Thread
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Tool
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Tube
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Wheel
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Wire
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Worm
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Wrench
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION MACHINES, Visual
American Cystoscope Makers Inc., 1241 Lafayette Ave., New York, N. Y.

INSPECTION MACHINES, X-Ray
General Electric Co., Schenectady, N. Y.

INSPECTION METHODS AND EQUIPMENT
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSPECTION SERVICE
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSTRUMENTS, Measuring
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSTRUMENTS, Recording
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INSULATING MATERIALS
Continental-Diamond Fibre Co., Newark, Del.

INTENSIFIERS, Hydraulic
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Baldwin-Lima-Hamilton Corp., Philadelphia 42
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Northwestern Tool & Engrg. Co., 117 Hollier Dayton, Ohio.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E Nine Mile Rd., Detroit 20, Mich.

JOINTS
See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.
Morton Mfg. Co., Muskegon Heights, Mich.

KNURL HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.

LAPPING MACHINES
Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.).

(*Continued on page* 438)

For more information on products advertised, use Inquiry Card, page 261

OSBORN

Takes off metal whiskers 6 times faster

...IMPROVES QUALITY

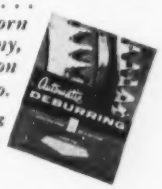
Your Problem may be far removed from the deburring of electric shaver heads . . . but, if it involves cleaning or finishing of any kind, the answer may be found quickly with the help of your **O**sborn **B**rushing **A**nalyst.

Here, he helped convert a hand operation to automatic power brushing that greatly improved the product and increased output.

The job: To remove fine burrs at the slots of shaver heads and blend the surface junctures at the ends. The **OBA** helped develop the application of two Osborn brushes to an automatic "push-button" operation. Shaver heads are mounted in clamp fixtures on a rotating table. One brush runs clockwise and the other counter-clockwise, producing perfectly smooth, uniform surfaces. One operator turns out more than 1000 pieces per hour, compared to an output of about 150 per manhour formerly.

An Osborn Brushing Method can benefit *your* cleaning and finishing operations. Call your . . . **OBA** or write *The Osborn Manufacturing Company, Dept. D-11, 5401 Hamilton Ave., Cleveland 14, Ohio.*

FREE: *New booklet on deburring with Osborn Power Brushing. Write for your copy.*



Osborn Brushes

OSBORN BRUSHING METHODS, POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.

LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hendey Machine Co., Inc., Torrington, Conn.
Jones & Lamson Mch. 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHE CONVERTER

Master Mfg. Co., Hutchinson, Kansas.

LATHES, Automatic

Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

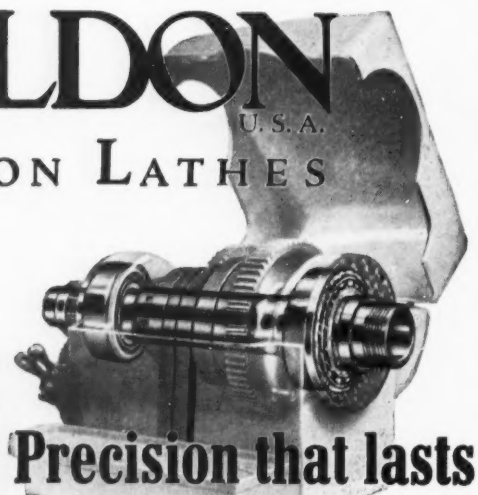
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(*Continued on page* 440)

SHELDON
CHICAGO U. S. A.
PRECISION LATHES



Precision that lasts
. . . "ZERO PRECISION"
TAPER ROLLER BEARINGS

SHELDON
"Stamina" Features:

- Rigid, Heavily cross-strutted 1-piece Beds—2 V-ways, 2 Flat ways
- Full Double-Walled Aprons—all gear shafts supported on both ends
- Heavy Carriage with wide bearing on bed
- Twin V-Belts to Spindle for extra power

No lathe can be more accurate than its spindle bearings. Hence before buying any lathe one should check the *exact* type and tolerances of bearings used.

The No. TS-56B (and several other) SHELDON Precision Lathes have "Zero Precision" Taper Roller Bearings, held to tolerances of .00015". Not only are these the most accurate bearings used in any lathe, they are the sturdiest type . . . hold their accuracy thru long hard use . . . hold it even under abuse. With the other stamina features built into SHELDON Precision Lathes, they assure continued accuracy, without costly maintenance, thru years of hard service.

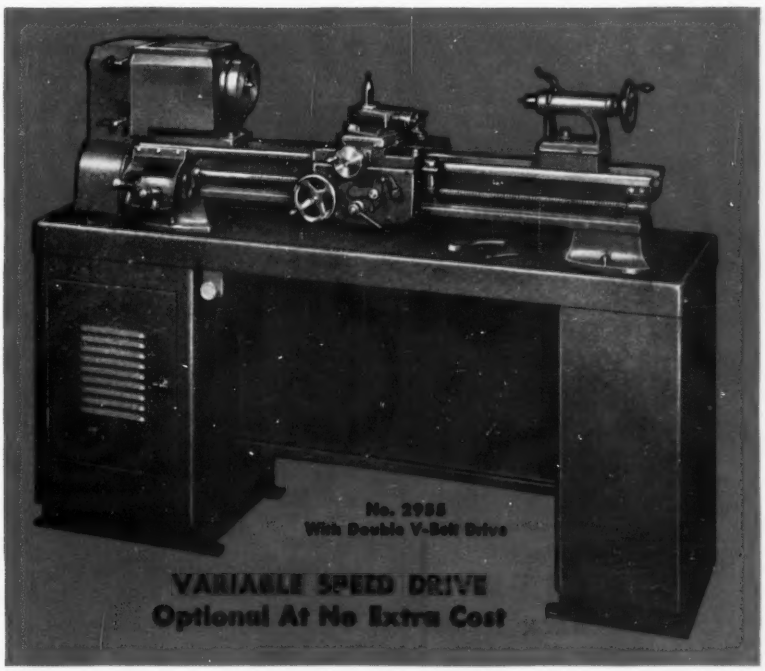
Write for Catalog

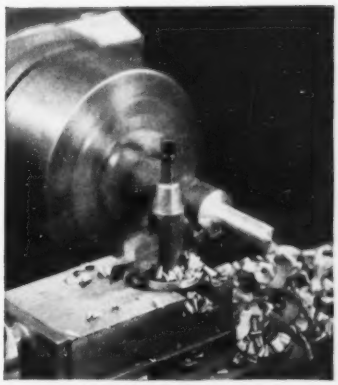
SHELDON MACHINE CO., INC.
4246 N. Knox Ave., Chicago 41, Illinois

For more information on products advertised, use Inquiry Card, page 261

VERSATILE 12" SWING LOGAN LATHE

FOR PRODUCTION, TOOL ROOM, MAINTENANCE, SCHOOL SHOP





SMOOTH
On Heavy Cuts

With smooth power this 12" Logan hogs out a .375" cut from bar stock. Extra weight in the headstock . . . a massively proportioned spindle turning on oversize ball bearings assure the rigidity and sustained accuracy that makes heavy cuts easy.

ECONOMY
In Production

Typical parts made on Logan Lathes and held to closest tolerances at minimum cost per finished part. Rugged, accurate Logan construction keeps production lines going at top efficiency.

In versatility, accuracy and value, this 12" Logan Lathe is *new*. Wide speed range, sustained accuracy, and rigidity on heavy cuts are inherent in its massively proportioned ball bearing spindle construction. Its heavy headstock, double V-belt drive, and heavy-ribbed bed with two V-ways and two flat ways precision ground to within .0005", mean lasting accuracy on production lines. The completely machined saddle and large, accurate dials are typical of the features which adapt it to exacting tool room work. With 1" collet capacity, 1⅜" spindle hole, and either 23" or 35" center distances, the 12" Logan has the size to meet most shop requirements. Simple and safe to operate, it is well adapted to student training. In brief, this 12" Logan can put new efficiency and more profit in your lathe turning operations.

SEE IT AT YOUR LOGAN LATHE DEALER'S, OR

Write for Information . . .

Full catalog descriptions and price information on request. ***Write today to***

Logan
ENGINEERING CO.
Lawrence and Larrabee Avenues
Chicago 35, Illinois

Brief Specifications

Swing over bed and saddle wings, 12" . . . Center Distances, 23" and 35" . . . Turret Lathes Models have 43" bed length . . . 1¾" spindle hole . . . 1" collet capacity . . . 16 V-belt drive spindle speeds, 35 to 1230 rpm. . . . Variable speed drive, infinite spindle speeds, 38 to 1575 rpm.

LOOK TO LOGAN FOR BETTER LATHES AND SHAPERS

For more information on products advertised, use Inquiry Card, page 261

LATHES, Duplicating

H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

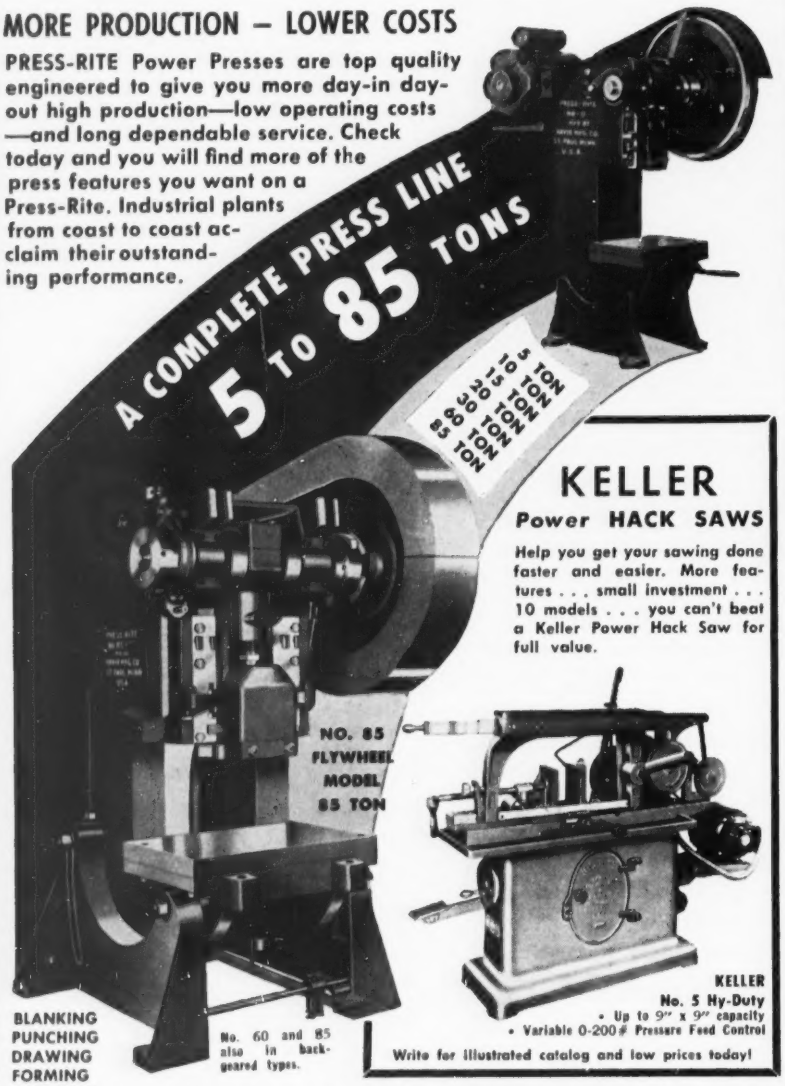
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hendey Machine Co., Inc., Torrington, Conn.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Corp., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

MORE PRODUCTION — LOWER COSTS

PRESS-RITE Power Presses are top quality engineered to give you more day-in day-out high production—low operating costs—and long dependable service. Check today and you will find more of the press features you want on a Press-Rite. Industrial plants from coast to coast acclaim their outstanding performance.

A COMPLETE PRESS LINE 5 TO 85 TONS

5 TON
10 TON
15 TON
20 TON
30 TON
60 TON
85 TON



BLANKING
PUNCHING
DRAWING
FORMING
STAMPING

No. 60 and 85 also in back-geared types.

KELLER
Power HACK SAWS

Help you get your sawing done faster and easier. More features . . . small investment . . . 10 models . . . you can't beat a Keller Power Hack Saw for full value.

KELLER
No. 5 Hy-Duty
• Up to 9" x 9" capacity
• Variable 0-200# Pressure Feed Control

Write for illustrated catalog and low prices today!

Write for catalog with specifications of all models.

Sales Service Machine Tool Co. SSMT
PRESS RITE PRESSES • SHAPE RITE SHAPERS • KELLER POWER HACK SAWS
2351 UNIVERSITY AVENUE • ST. PAUL 4, MINNESOTA

LATHES, Gap

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom.

LATHES, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

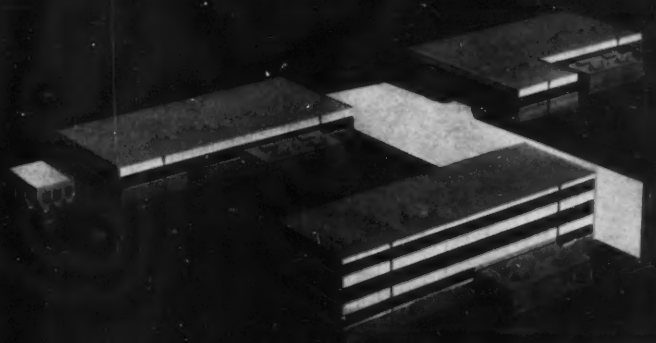
(*Continued on page* 442)

For more information on products advertised, use Inquiry Card, page 261

PEERLESS

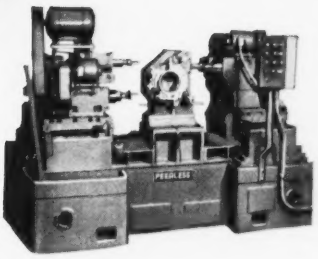
DETROIT PLANT

Plants, Facilities and
Proven Know-How to Produce
All Types of *SPECIALIZED*
Production Equipment

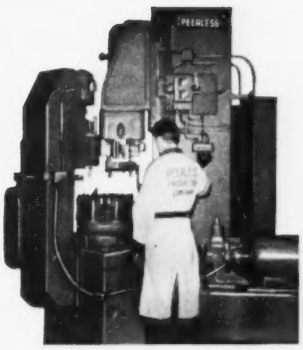


POTTSVILLE (Pa.) PLANT

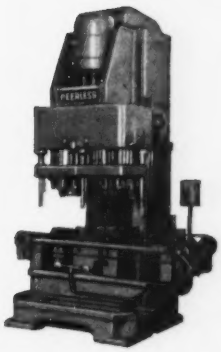
Five examples
of Typical
PEERLESS
SPECIALIZED Production
Equipment.



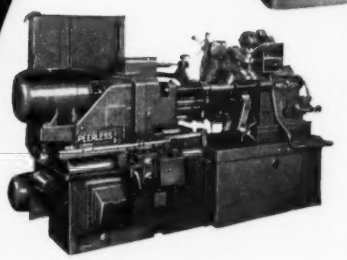
Double-End Traveling Precision-Boring Machine with Automatic Spindle Positioning Slide.



Multiple-Station Hydraulic-Feed Vertical Drilling and Tapping Machine with Automatic Indexing.

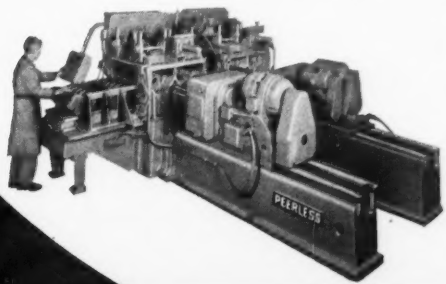


Heavy-Duty Hydraulic-Feed Vertical Driller with Sliding Carriage.



Single-End, Hydraulic-Feed Trunion Machine

Double-End In-Line Automatic Transfer Machine for Boring Camshaft Bearings and Drilling Front and Rear Face of Cylinder Block.



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20 SPECIALIZED MACHINES ILLUSTRATED, TOGETHER WITH TOOLING AND PARTS DRAWINGS.

PEERLESS PRODUCTION CO.
19947 Glendale Ave., Detroit 23, Mich.

Gentlemen: Please send me your catalog.

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Title _____

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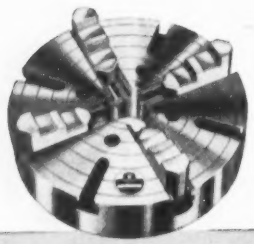
this name is your guarantee of dependable performance . . . backed by 102 years experience in the manufacture of the world's finest chucks.



See your Distributor for a complete line of chucks by Horton — pioneer in J-Type chucks for jet engine machining.

HORTON CHUCK
Since 1851

DIVISION OF
THE E. HORTON & SON CO.
WINDSOR LOCKS, CONN.

LATHES, Vertical Turret
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS
Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

LUBRICATING SYSTEMS
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Farvel Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS
See Arbors and Mandrels.

MARKING MACHINES AND DEVICES
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.

MASKS, Painting
Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MEASURING MACHINES AND INSTRUMENTS, Precision
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

METAL, Bearings
See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS
See Recording Instruments.

MICROMETERS
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Groton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

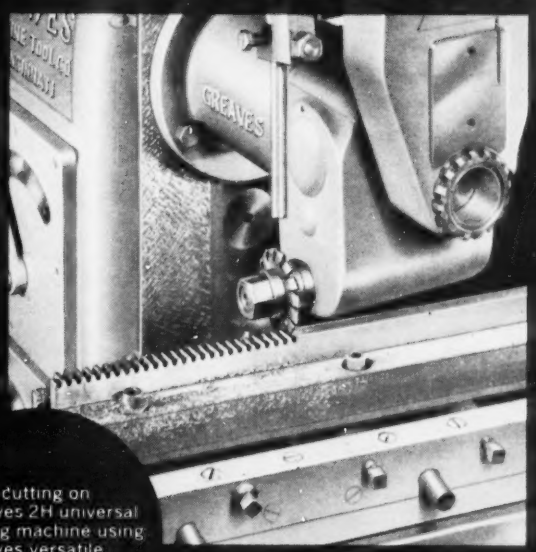
MILLING MACHINES, Bench
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

(*Continued on page* 444)

comparison proves GREAVES costs less performs with the best



Rack cutting on Greaves 2H universal milling machine using Greaves versatile rack cutting attachment

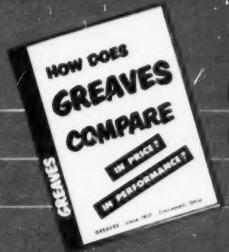
Greaves 2H Universal Milling Machine

Before you buy . . . get the facts! When it comes to speeds, feeds, power and capacity, the Greaves 2H plain and universal milling machines are right around the top. But when you're talking about original purchase price and cost of operation and maintenance, Greaves is lowest!

Make your own comparison! Don't just take our word for it . . . send today for chart comparing the eight leading milling machines. See for yourself why Greaves is your best buy.

GREAVES MACHINE TOOL CO.

CINCINNATI 2, OHIO, U. S. A. ESTABLISHED 1917 DIV. J. A. FAY & EGAN CO.



Please send me chart comparing the 8 leading U.S. milling machines for price, capacity, power and other significant specifications.

GREAVES MACHINE TOOL CO.
2500 Eastern Avenue
Cincinnati 2, Ohio

NAME

COMPANY

ADDRESS

CITY ZONE STATE

Guarantee

We guarantee that Pittsburgh ARMORED GEARS, of our own laboratory specification steel and Armoring will give an average service life:

1. FIVE TIMES THAT OF UNTREATED GEARS.
2. ONE TO ONE AND ONE HALF TIMES THAT OF OIL TREATED GEARS, and
3. EQUAL OR SUPERIOR TO THE AVERAGE SERVICE LIFE OF ANY OTHER HEAT TREATED GEAR IN IDENTICAL SERVICE.

GUARANTEED PITTSBURGH ARMORED GEARS Reg U S Pat Off

that's right...

Pittsburgh **ARMORED GEARS** are sold to you with this positive guarantee of satisfactory service. It means that they will give you longer service, fewer work-stoppages, and lower operating costs.

There is a reason for the longer life of Pittsburgh **ARMORED GEARS.** It comes from a combination of the correct metal, quality machining, PLUS a process of heat-treating that hardens the wearing surfaces but leaves the core tough and shock-resistant.

Next time try a Pittsburgh **ARMORED GEAR.** You can identify it by its exclusive Pittsburgh purple protective coating. Let it prove its worth. Then standardize on these guaranteed gears for continued savings. Send your specifications to us today for quotation on one or any quantity of gears you need. We'll give you prompt service.

Look for **"Pittsburgh Purple"** on the gears you buy.

SPUR, MITRE
HELICAL
HERRINGBONE
WORM GEARS
REDUCERS
CRANE WHEELS

the **RIGHT** hardness in the **RIGHT** places

PITTSBURGH GEAR COMPANY | 27th & Smallman Streets, Pittsburgh 22, Pa. Phone: ATlantic 1-9950

subsidiary: **BRAD FOOTE GEAR WORKS, INC. • CICERO 50, ILLINOIS**

MILLING MACHINES, Hand

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Columbia Export Co., Inc., 10-35 44th Dr., Long Island City, N. Y.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Fray Machine Tool Co., 151 W. Windsor Rd., Glendale 4, Calif.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st. St., Milwaukee 14, Wis.
Marac Mchry. Corp., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R. Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Planetary Type

Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Groton, Geo., Mch Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

(*Continued on page* 446)

For more information on products advertised, use Inquiry Card, page 261

One demonstration, and key men agree

NEW Scott Industrial Wipers

are better than anything they've ever used for most industrial wiping jobs.

We expected that years of testing and research had made this a good product. Still, we never thought that Scott Industrial Wipers would catch on so quickly with so many key men in so many different kinds of plants.

Scott Industrial Wipers have only been on the market a few months. But, already, Plant Managers and Superintendents, Industrial and Methods Engineers, Production Supervisors, Head Storekeepers, Purchasing Agents —as well as the workers themselves—have been enthusiastic about them. Here's why:

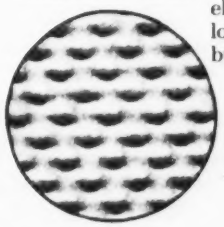
Safety Scott Wipers are disposable. This means that harmful filings, oils, and shavings are thrown away, along with the used wipers. Clean edges reduce chances of catching in moving machinery.

Cleanliness Because a new clean one is always available, you can have a wiper free from chips and foreign matter thus helping eliminate the carrying of dermatitis.

Uniformity Each wiper is of standard size, color and absorbency. Every inch is a highly effective wiping surface. From experience you will soon know the exact wiping requirements of each job.

Versatility Soft but strong, Scott Industrial Wipers tackle almost any job . . . from oil wiping and glass wiping to polishing and use on the face and hands.

Cost control Naturally, with sorting and counting eliminated, expensive controls are no longer necessary. Wiping now can be a budgeted production operation.



Close-up of wiper surface showing "PERF-EMBOSSED" texture which grips dirt and assures thorough cleaning

Most plants have found a 90-day trial—with a Scott representative working hand in hand with their supervisory personnel—the most accurate way of measuring the advantages of Scott Industrial Wipers.

For further information, fill out the coupon and mail to Scott Paper Company, Chester, Pa. M-A

Name_____

Position_____

Company_____

Address_____

City_____ State_____

For more information on products advertised, use Inquiry Card, page 261

Let your operator tell you . . .

. . . why REID GRINDERS are the easiest to operate!

. . . Turn a good man loose with a Reid precision grinder for five minutes. The first thing he'll tell you is that a Reid grinder is the *easiest* to operate. Ask him why, and he'll point out these features:

. . . A competent operator knows a competent machine when he sees—and operates one. Reid's 50 years of experience in building grinders produce a *co-ordinated* design for greater efficiency of precise operation. That's why REID is the operator's preference throughout industry.

Write for latest illustrated bulletin (618-2) with specifications of power and hand feed Reid Precision Surface grinders.

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

Kearney & Trecker Corp., Milwaukee, Wis.
Marac Mchry. Co., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

MOTORS, Hydraulic

Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

Nilson Machine Co., A. H., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel

International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp., (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

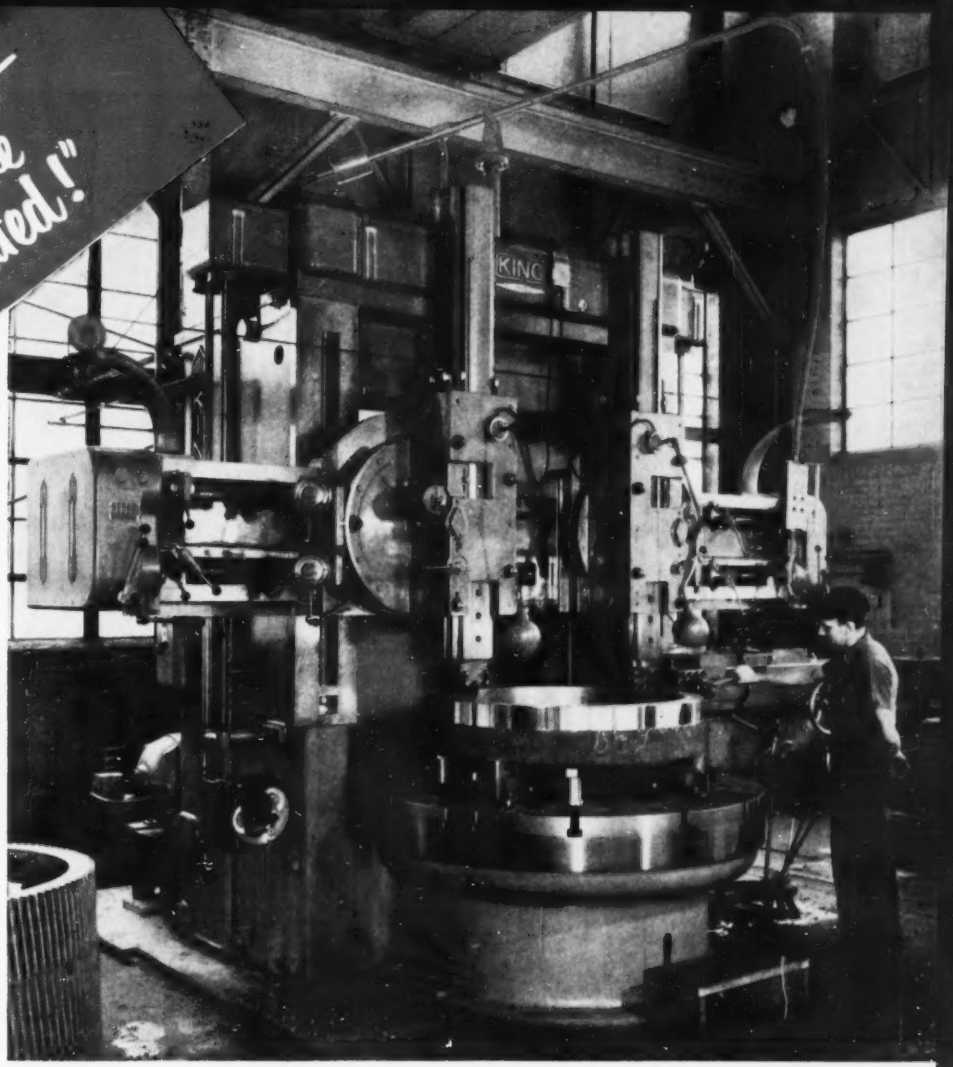
NUTS, Self-locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

(*Continued on page* 448)

For more information on products advertised, use Inquiry Card, page 261

"It's the most solid, smoothest-running machine I've ever operated!"



Says Veteran of Many Years on the Boring Mills at

THE TOOL STEEL GEAR & PINION CO. *(Cincinnati)*

The 72" boring mill pictured here is one of the many rugged, versatile KINGs with unmatched performance records at "Tool Steel." This particular KING is shown machining the inner diameter of a 50" O.D. ring gear—one of a wide range of jobs handled. At the controls is operator Arthur "Babe" Wilson. From long and diversified boring mill experience, Mr. Wilson knows the KING is really "king" in operating efficiency—and in the above quoted statement, he enthusiastically says so.

Massive proportions and extra-heavy construction give all KING machines the *rigidity* essential for fast, heavy work with consistent precision accuracy. Also, a wider feed and speed range plus simplified control make the KING adaptable for all types of boring, turning, and facing work—light or heavy, large or small.

KING machines are available in ten sizes, from 30" to 144", and in a variety of head combinations, with or without side head. For complete details, contact your local KING distributor—or write us direct.

Supreme
in Power, Speed, Accuracy . . .
SOLID RIGIDITY
KING
VERTICAL BORING & TURNING MACHINES

American Steel Foundries

KING MACHINE TOOL DIVISION

1150 TENNESSEE AVENUE CINCINNATI 29, OHIO

Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

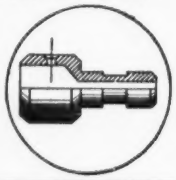
For Top Production

SNOW

FULL UNIVERSAL MACHINES

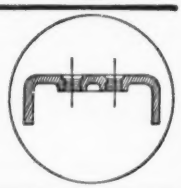
Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING



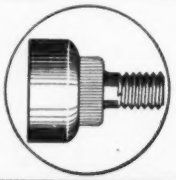
Crossdrill and C"T" Sink 1/16" Hole
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

TAPPING



Tap Two #10-32 Holes
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING



3/8"—24 Thread—1/2" Long
Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine

Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

Submit Sample Parts f

SNOW
MANUFACTURING COMPANY
433 Eastern Ave., Bellwood, Illinois
(Chicago Suburb)

Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

NUTS, Thumb or Wing and Cap
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.

OIL CUPS
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Wicaco Machine Co., Stenton Ave. and Louden St., Philadelphia, Pa.

OIL-HOLE COVERS
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL SEALS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Bellows Co., 230 W. Market St., Akron, Ohio.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

OILS, Quenching and Tempering
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble
See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.

ORDNANCE MACHINES, Spelial
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

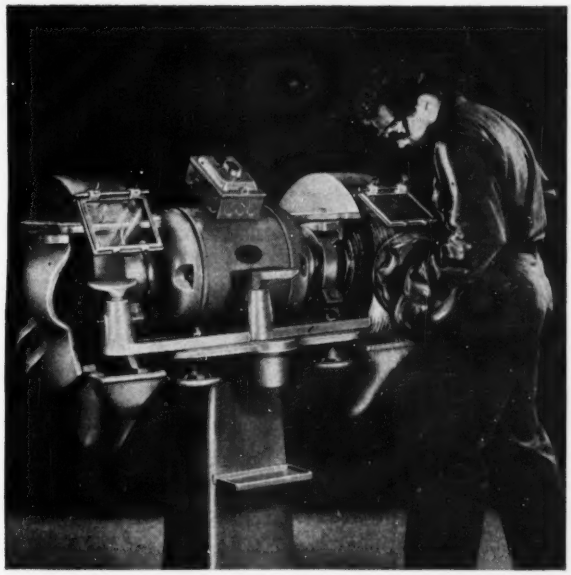
PAINTING EQUIPMENT, Spray
Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis 7, Ind.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

(*Continued on page* 450)

For more information on products advertised, use Inquiry Card, page 261



PUT THIS U.S. GRINDER ON THE SPOT

...where you want to reduce costs

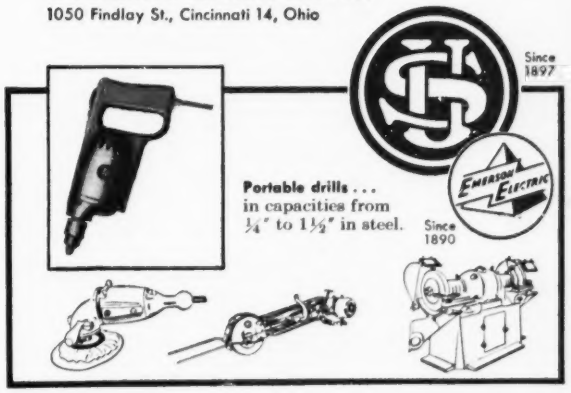
Check these U. S. Electrical Tool features—there are many cost-saving advantages in operating ruggedly-built Model 500 Grinders.

Standard equipment includes totally enclosed motor, 1 to 5 H.P., push button starter providing overload protection, ball bearings enclosed in dust-tight housings, enclosed adjustable wheel guards, tool tray and lift-out water pot. Eye shields and grinding wheels furnished as extra equipment. Furnished for 220/440 volt, 60 cycles, 2 or 3 phase AC.

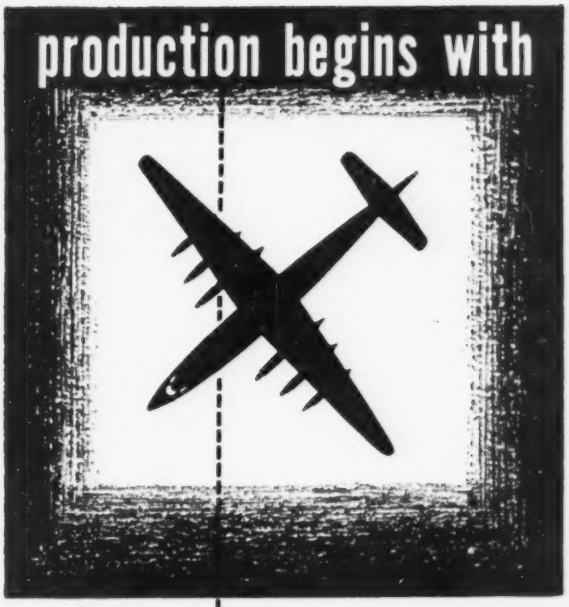
Model 500 Grinders are *available from stock for immediate shipment.*

The U. S. Tool line is complete, ranging from hand drills, sanders, grinders and buffers to heavy-duty snagging grinders. If you don't know your nearby U. S. Distributor write at once for his name and free Tool Catalog No. US 30

United States Electrical Tool Division
THE EMERSON ELECTRIC MFG. CO.
1050 Findlay St., Cincinnati 14, Ohio



production begins with



Columbus Die-Tool

Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 46 years. Talk over your special problems with us. Absolutely no obligation. Write today.

Columbus Die Tool
AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

Think of Perkins first and you can think of maintenance last!

WHEN the functional efficiency of your product is largely dependent upon the effectiveness of its integral power transmission system, the quality of the gears you need to transmit power is the major consideration.

Through its entire 35 years of operation, Perkins has specialized in the production of gears to customers' specifications—any size, any quantity, metallic or non-metallic. Consequently, among consumers of custom-made gears, PRECISION & PERKINS are accepted as synonyms. For trouble-free power transmission, specify Perkins custom-made gears. Have us quote on your requirements!

NOTE 1: A new product is the **Perkins Precision Spring Coiler.** This coiler (patent applied for) turns out precision springs – any type, shape, size, from wire sizes .005 to .125.

2: Another new product – the **Perkins "Bendit 15"** – a patented metal forming machine bends and shapes sheets, rods, strips tubing into innumerable complex as well as simple forms that would be difficult or impossible to make by other means. Eliminates need for expensive tools or specialized skills. Ht. 47", net wt. 200 lbs. Write today for descriptive catalogs, prices etc.

Perkins Machine & Gear Co.
Springfield, Massachusetts

This is an aircraft engine gear custom-made by PERKINS.

PERKINS ALSO MAKES:
Helical Gears
Bevel Gears
Sprockets
Ratchets
Worm Gears
Spiral Gears
Spur Gears with shaved or ground teeth
Ground Thread Worms

PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Shafer Bearing Div., Chain Belt Co., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, BRASS AND COPPER

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE STEEL

Alleghany Ludlum Steel Corp., Pittsburgh, Pa
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave and Penn R. R., Evanston, Cincinnati, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTIC AND PLASTIC PRODUCTS

Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

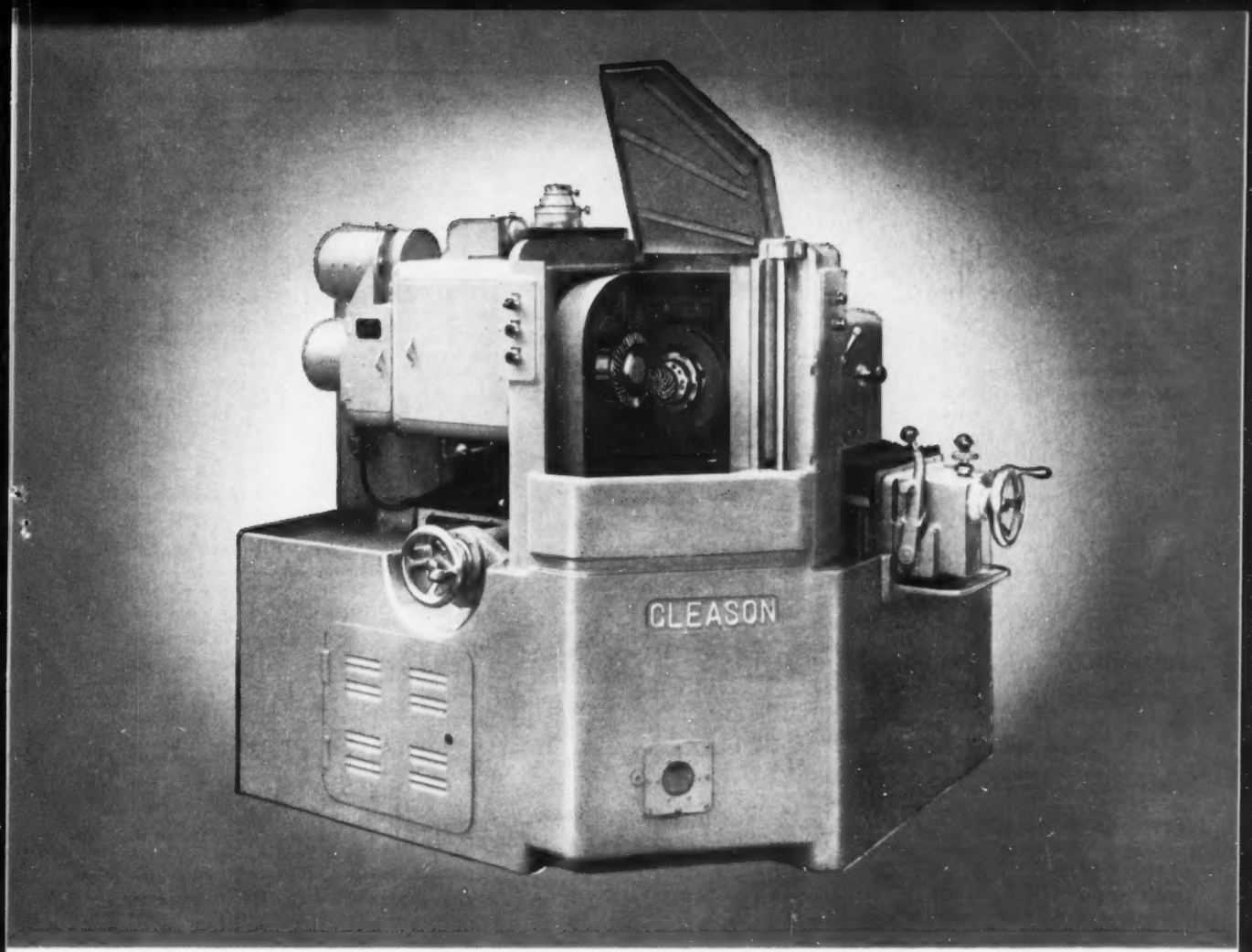
PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

(Continued on page 452)



SPIRAL BEVEL AND HYPOID GEARS

Lapped faster, better than ever before

The new **No. 19 Hypoid Lapper** is simpler to set up, has greater productivity, and assures improved quality of lapped gears up to 17" diameter. Entirely new machine features include dial-operated controls, elimination of cam systems, and automatic positioning throughout entire lapping cycle.

The No. 19 Hypoid Lapper is ideal for volume production or small quantities.

GLEASON WORKS

Rochester 3, New York

GLEASON

PNEUMATIC EQUIPMENT

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Bellows Co., 230 W. Market St., Akron, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

POLISHING LATHES AND MACHINES

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Gardner Machine Co., (Div. Landis Tool Co.), 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

POLISHING TOOLS, Portable

Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Jarvis, Charles L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads.

PRESSES, Air

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

PRESSES, Arbor

Bellows Co., 230 W. Market St., Akron, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago,
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Die Tryout

Alpha Tool Works, 9281 Freeland Ave., Detroit 28, Mich.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati,
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave. Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Clifton Hydraulic Press Co., Clifton, N. J.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Sheet Metal Working

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co Southington, Conn.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Watson-Stillman Co., Div. H. K. Porter Co. Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, (Hydraulic) 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

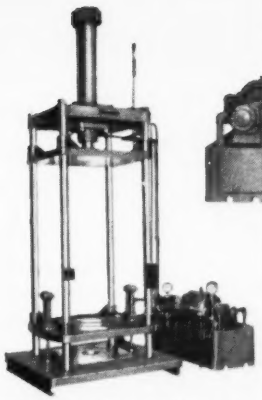
PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa., (Lathe)

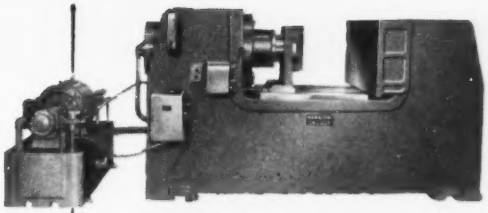
PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Mchry Co., Inc. (and affiliated companies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pines Engineering Co., Inc., Aurora, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

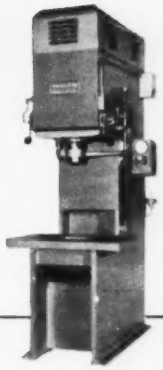
(*Continued on page* 454)



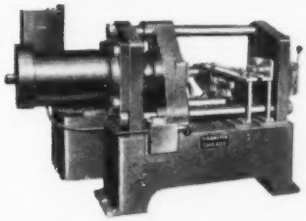
WATER HEATER TANKS are assembled with this 50-ton, 4-column press. Special hydraulic stripper plate raises tank from lower die after assembly.



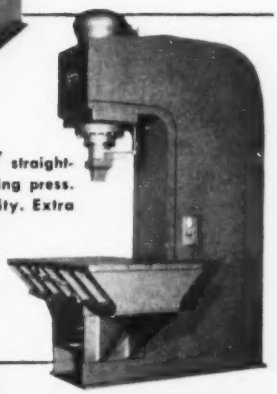
TRACTOR WELDMENTS for main frames and roller frames are straightened with this 100-ton press. Horizontal design permits use of hoist for easier handling.



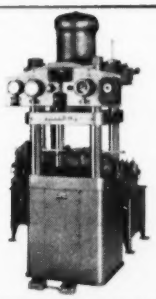
DIE CASTINGS are trimmed on this 25-ton, long stroke, open gap press. Controls reverse on distance; extremely high speed advance and return. Easy on dies. Scrap chute in table.



TRACTOR TRACK LINKS are press-fit assembled in this 50-ton, 3-column press. Assembly includes bushings and connecting pins. Press indexes for various sized links.

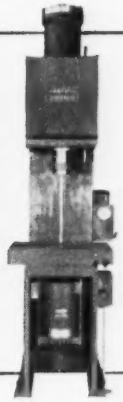


HEAVY DUTY straightening and forcing press. 150-ton capacity. Extra reach and large table permit handling heavy work.

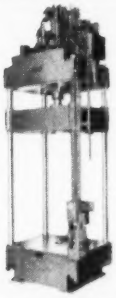


HELICAL CUTTER BLADES are formed with this 75-ton, 4-column press. 2-step, timer-controlled operation forms part. Special attachment ejects part and relubricates dies with graphite.

WHEN IT COMES TO PRESSES ...COME TO HANNIFIN



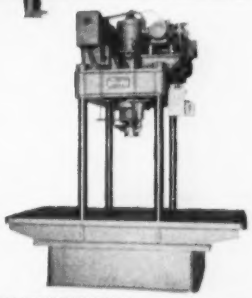
GENERAL PURPOSE 25-ton open gap press. Die cushion under table permits use for drawing operations.



FIBERGLAS PLASTICS are molded with this 50-ton, 4-column platen press. Automatic controls permit high-speed approach, slow closing on dies. Long stroke and extra "daylight" for deep parts.

When your production calls for hydraulic presses, investigate the Hannifin line that includes more than 75 standard models, capacities to 150 tons.

Quite probably you can select the press you need directly from the complete Hannifin catalog . . . or a Hannifin Field Engineer will demonstrate how easily one of these standard models can be modified to meet your requirements. Hannifin Corporation, 1109 South Kilbourn Ave., Chicago 24, Ill.



LARGE WELDMENTS are straightened on this 75-ton, 4-column press. Sensitive pressure control, extra large work table.

Hannifin Representatives Are at Your Service in These Leading Industrial Centers

Atlanta, Buffalo, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Houston, Los Angeles, Milwaukee, Minneapolis, Moline, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, Seattle, Richmond, Va.; Rochester, N. Y.; South Bend, Ind.; Washington, D. C.; Worcester, Mass. In Canada: Tem Sales Company Limited, Toronto and Windsor.

HANNIFIN

Hydraulic Presses • Pneumatic Presses • Hydraulic Riveters
Hydraulic Cylinders • Air Cylinders • Air Control Valves

WRITE FOR BULLETIN 130

Hannifin Corporation
1109 S. Kilbourn Ave., Chicago 24, Illinois
Please send me Bulletin 130 on Hannifin Hydraulic Presses.

Name.....

Position.....

Company.....

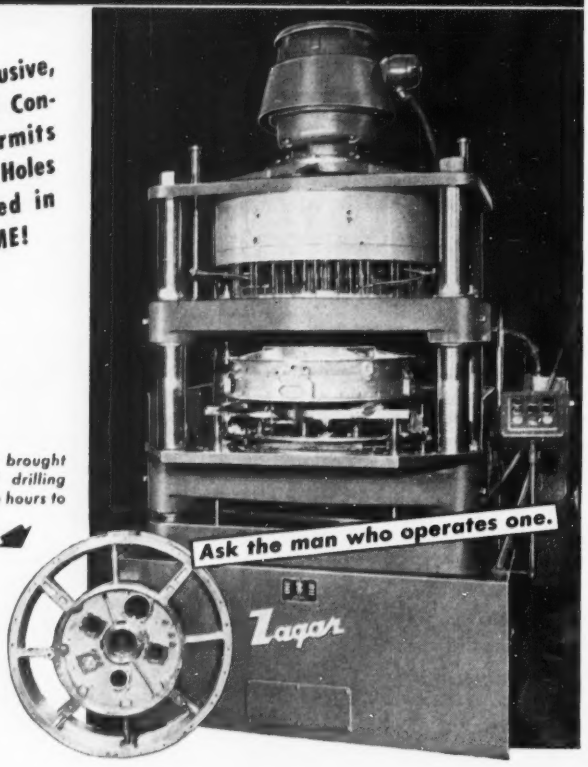
Address.....

City.....*State*.....

For more information on products advertised, use Inquiry Card, page 261

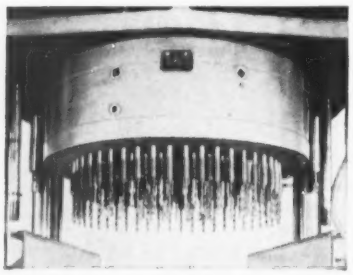
Packard, Too, Uses Zagar ENGINEERED DRILLING IN STANDARD ZAGAR DRILLING MACHINES

Zagar's Exclusive, Rigid 4-Post Construction Permits Hundreds of Holes to Be Drilled in RECORD TIME!



Zagar engineering brought down the time of drilling this part from three hours to seven minutes.

This jet engine part suggests the almost unlimited possibilities in drilling hundreds of holes at one pass. Zagar 4-post machines are built around interchangeable gearless drillheads. Any number of holes on all centers can be drilled as close as twice drill diameter in any material. Zagar's 4-post machines achieve heavy duty, multiple-spindle, close center drilling. . . with greater horsepower and thrust, with better alignment and accuracy, with less breakage of *small drills*. . . Let our engineers calculate your savings by demonstrating the Zagar method.



Zagar Interchangeable Drillhead.

★ ★ ★

Write for Catalog M-11.

ZAGAR TOOL, INC. 24000 LAKELAND BLVD. CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

PULLEYS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch
Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Ill.

PUMPS, Rotary
Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES
See Dies, Sheet-Metal, Etc.

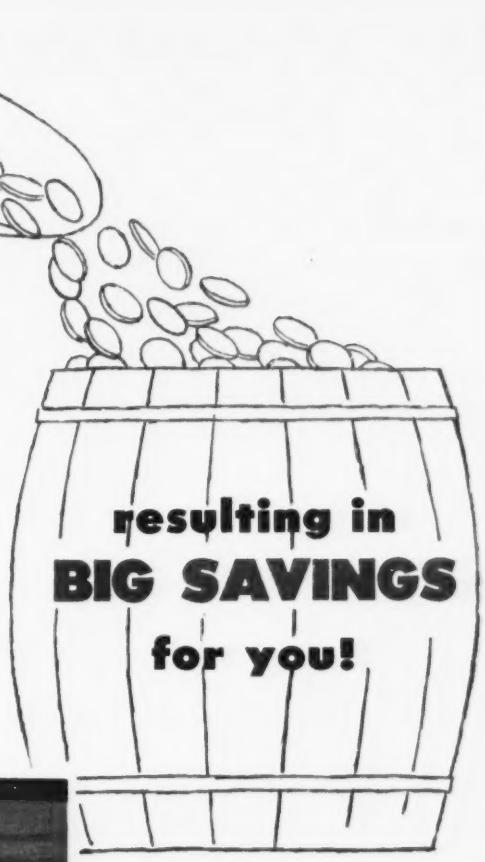
PUNCHES, Centering
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

(*Continued on page* 456)

For more information on products advertised, use Inquiry Card, page 261

another SCOOP by LAPOINTE



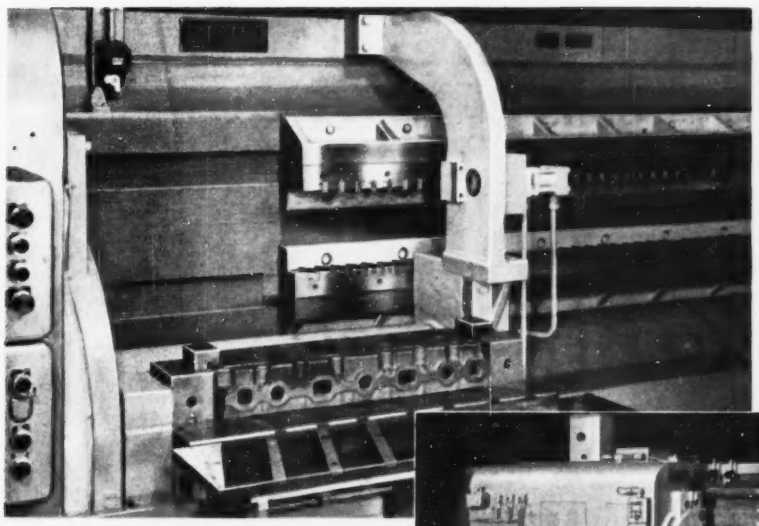
resulting in BIG SAVINGS for you!

Leading the field in broaching machine design and engineering, LAPOINTE'S radical, new

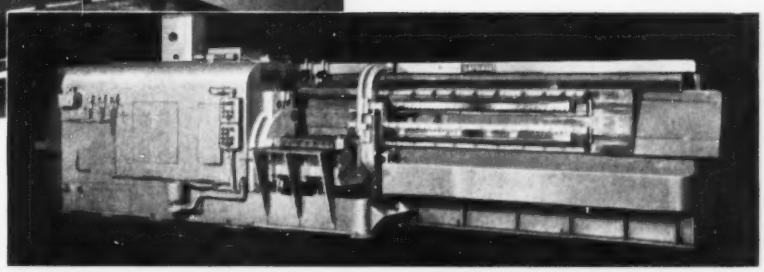
ELECTRO-MECHANICAL DRIVE horizontal BROACHING MACHINE

is already performing production miracles in automotive plants. Broaching speeds of 50 to 150 feet per minute are practical with conventional type broaches, but carbide-tipped broaches can be used when taking advantage of the machine's amazing broaching capacity up to 300 feet per minute . . . and more!

For full information, send for Bulletin **SRHE-1**



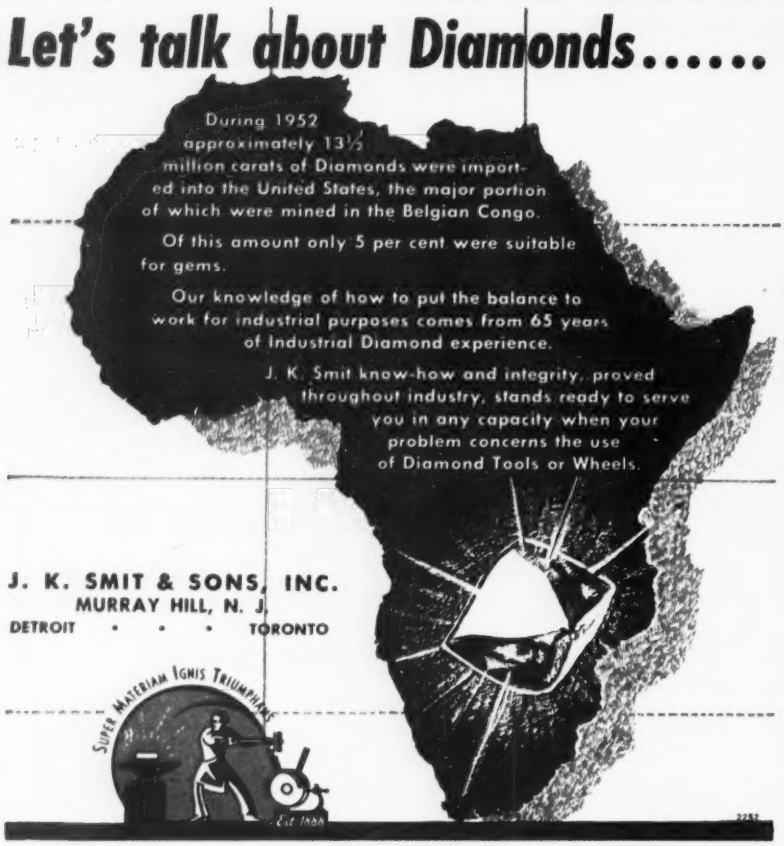
Operating entirely without vibration or chatter, this Lapointe SRHE Broaching Machine, 50 hp, 150-inch stroke, removes 3/16" stock per surface on the manifold face and opposite pads on cast iron *Cylinder Head* parts. Return speed is 150 feet per minute. Yield is 120 completed parts per hour at 80% efficiency. This lack of vibration results in *longer tool life* of 100% or more!



The exclusive Lapointe "Tilt-In" Fixture and work holder are hydraulically operated in synchronism with the broach assembly travel, so there is no delay awaiting the return stroke.

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES


Let's talk about Diamonds.....
During 1952 approximately 13½ million carats of Diamonds were imported into the United States, the major portion of which were mined in the Belgian Congo.
Of this amount only 5 per cent were suitable for gems.
Our knowledge of how to put the balance to work for industrial purposes comes from 65 years of Industrial Diamond experience.
J. K. Smit know-how and integrity, proved throughout industry, stands ready to serve you in any capacity when your problem concerns the use of Diamond Tools or Wheels.
J. K. SMIT & SONS, INC.
MURRAY HILL, N. J.
DETROIT • • • TORONTO
SUPER MATERIAM IGNIS TRIUMPHANS
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2252

"To sum it up, chief, we can do it if we use Columbia MAXITE Tungsten-Cobalt High Speed Steel."

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels—High Speed Steels Die Steels—Hot Work and Shock Resisting Steels Carbon Tool Steels.

TOOL COLUMBIA STEELS

Famco Machine Tool Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14 Ohio.

REAMER HOLDERS

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

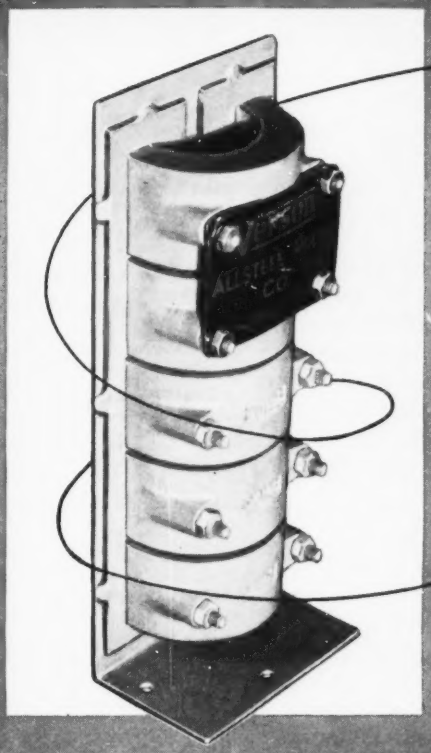
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

(*Continued on page* 458)

For more information on products advertised, use Inquiry Card, page 261



THIS SIMPLE DEVICE *

can save you time, money and manpower

Verson

SHEET FLOATER

Use it like this

TO SIMPLIFY SEPARATION OF STACKED STEEL SHEETS AND BLANKS

The Verson Sheet Floater eliminates the need for hand separation of sheets and blanks—the hard part of feeding sheet steel to presses, brakes and shears. Oily or burred sheets which are especially difficult to separate by hand, are quickly and easily separated by the Sheet Floater—ready for the operator's grasp.

The Sheet Floater is a completely self-contained unit, requiring no electrical or air connections. By setting up a magnetic field, it forces the stacked pieces apart—causes them to fan out for easy handling. This speeds up the feeding operation, reduces operator fatigue and releases man-power for other jobs. The danger to workers' hands is minimized as is the danger of die damage due to feeding more than one piece.

Two models—Standard and Heavy Duty—are each available in 6″, 8″, 10″ and 12″ sizes. Either model will handle rectangular, round or irregular shaped pieces. Write today for bulletin and prices.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information on products advertised, use Inquiry Card, page 261

Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Greaves Machine Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS for Counting

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

REELS, Stock, Standard and Automatic

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORIES, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.

Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Peck, Stow & Wilcox Co., Southington, Conn.
Thor Power Tool Co., Aurora, Ill.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS

Garlock Packing Co., Palmyra, N. Y.

RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

SANDERS

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburgh, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg Co., 1050 Findlay St., Cincinnati 14, Ohio. Portable Electric.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Victor Saw Works, Inc., Middletown N. Y.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp., 401 Broadway, New York 13, N. Y. (Portable.)
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Ohio.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

(*Continued on page* 460)

For more information on products advertised, use Inquiry Card, page 261

40 YEARS

OF LEADERSHIP

Management and employes take pride in announcing to our many friends and customers that Eclipse Counterbore Company became 40 years of age in May. From a humble beginning in 1913 to a position of leadership in 1953, Eclipse is today truly synonymous with quality in the cutting tool industry. This healthy maturity could never have been attained without the help of those same friends and customers . . . and so to them we say "Sincere Thanks."

The orginal Eclipse interchangeable single-diameter counterbore created in 1913.

A modern multi-diameter carbide tipped Eclipse Cutter.

ECLIPSE COUNTERBORE CO.

Founded in 1913

DETROIT 20, MICHIGAN

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

SCREW MACHINE TOOLS AND EQUIPMENT
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave., and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand
See also Lathes, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp, Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Set Screw & Mfg. Co., 35 Main St., Bartlett, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive
Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

SCREWS, Thumb
Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

SEALS AND RETAINERS, Oil or Grease
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.
Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal
De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant
Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible
Jarvis, Chas. L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

SHAFTS, Hollow-Bored
Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

(Continued on page 462)

there's a *db in gears

*Decibel (db) tolerances in gears can be important—and if your gear needs call for minimum db tolerances—for *silent* operation—you'll be interested in the unique "extra service" offered by The Cincinnati Gear Company: scientific sound inspection. Each gear you order can be individually *sound-checked* with modern electronic testing equipment for the most exacting noise limits, under a specified load and RPM. No guesswork—the exact decibel noise ratio is registered on the dial pictured—your assurance of truly silent gear operation. Inquire today for complete details.

SPUR
WORM
INTERNAL
SPIRAL BEVEL
HELICAL
HERRINGBONE
*CONIFLEX BEVEL
SPLINE SHAFT

*Reg. U. S. Pat. Off

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. • Cincinnati 27, Ohio

Modernizing for Profits?

VAPOR BLAST* Liquid Honing*

RECORDS LIKE THESE ▶

were made in Toolrooms and Production Operations like YOURS:

Forming Tools

VB LIQUID HONED

- 10,000 pieces instead of 2,500 before grinding (Forging Plant)

Dies

VB LIQUID HONED

- Cold Header Dies — Produced 72,000 bolts without filling up. (Bolt Manufacturer)
- Forge Hammer Dies — Ran 4 times longer before repairs (Forging Manufacturer)

(*Names and details upon request)

Cutting Tools

VB LIQUID HONED

- Used 7 to 9 hours — instead of former 20 min. to 2 hours!
- Cut 7 to 8 times longer! (Aircraft Manufacturer)
- Ran 200% longer! (Control Manufacturer)

Hobs

VB LIQUID HONED

- Ran 8 hours instead of former 2 hours (Watch Manufacturer)
- Delivered 5,000 pieces — formerly 600 pieces (Clock Pinions)

Liquid Honing*

You can easily pay for modern VB LIQUID HONING in savings alone—in toolroom or production operations — or work in any kind of metal!

Here are some of the advantages you can expect with VB LIQUID HONING:

• Greatly increased tool life • Greatly reduced finishing costs • Improved tool performance • Simplified tool maintenance.

Use LIQUID HONING for quick feather burr removal after grinding — more efficient chip flow — better lubrication — reduction in stress concentration with less fatigue or chipping of cutting edges — on cutters, drills, taps, broaches. The results in tools, dies, molds will amaze you, too . . . Sufficiently to inspire a quick decision to add VB LIQUID HONING to your toolroom or production line — for modernizing your operation to greater profit.

VAPOR BLAST LIQUID HONING Cabinets are self-contained, easily installed. Adaptable also to automatic processing with conveyors, turntables, and tumbling barrels. Available in small toolroom models and larger standard or custom-built units to fit your needs. Shown is Model 3030, Type B20, 30" x 30" Liquid Honing Machine.

*"VAPOR BLAST" is a trademark
*"LIQUID HONING" is a trademark

*VAPOR BLAST MFG. CO.

MILWAUKEE 16, WIS.

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VAPOR BLAST MFG. CO.
3007-K W. Atkinson Ave., Milwaukee 16, Wis.

☐ We are sending you a part for FREE DEMONSTRATION of VB Liquid Honing and analysis — without obligation.
☐ Please send complete details on VB Liquid Honing.

Our product is .....
Firm .....
Address .....
Attn. of .....

For more information on products advertised, use Inquiry Card, page 261

SHAPER-PLANERS
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hendey Machine Co., Inc., Torrington, Conn.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Cold Drawn Steel
Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div. Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheriden Rd., Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS
Laminated Shim Co., Inc., Glenbrook, Conn.

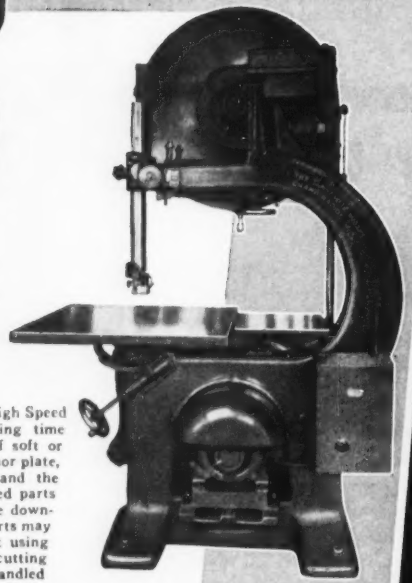
SLEEVES
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.

(Continued on page 464)

Greatest Cost Saver in METAL CUTTING

Cutting Hard-Tempered 1/8" Chrome Moley Steel

Sawing 16" Steel Piling



FRICTION sawing with Tannewitz High Speed Band Saws results in perfectly amazing time savings in the cutting of flat sheets of soft or hardened steels, non-ferrous metals, armor plate, glass, plastics, many other materials and the trimming of castings. For cutting formed parts there's nothing to compare with it. The down-drag of the saw is so negligible that parts may be trimmed or sawn as desired without using a rest of any kind. Whatever your cutting requirements, chances are they can be handled faster and at less cost with Tannewitz High Speed Band Saws.

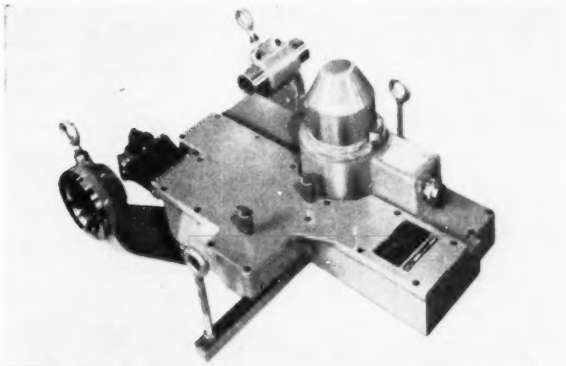
THE TANNEWITZ WORKS
GRAND RAPIDS, MICHIGAN

Write for Your Free Copy on Friction Sawing

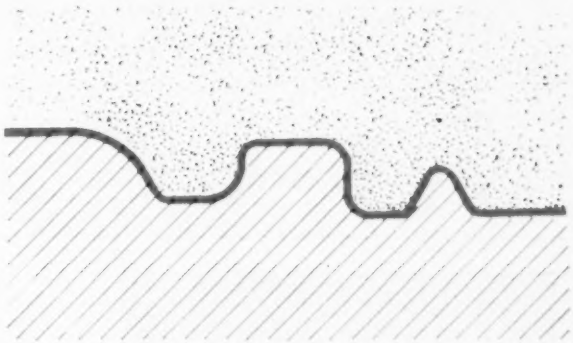
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

For more information on products advertised, use Inquiry Card, page 261

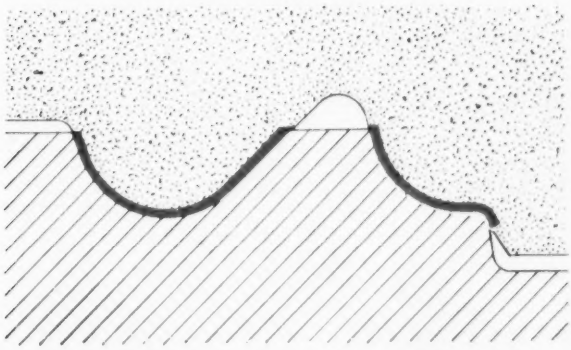
Key to Accurate, Fast Contour Grinding . . . A HOGLUND Automatic or Manual Dresser



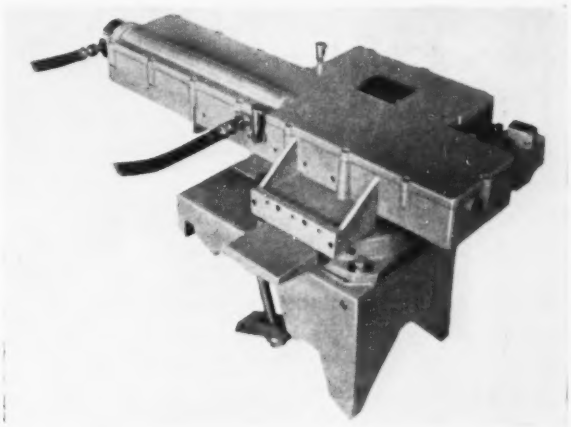
Automatically Electrically Operated Dresser, Model 40, designed to support between the centers of the grinder under the same conditions as the work piece is supported. Especially suited for grinding machines not having space anywhere else for mounting the dresser.



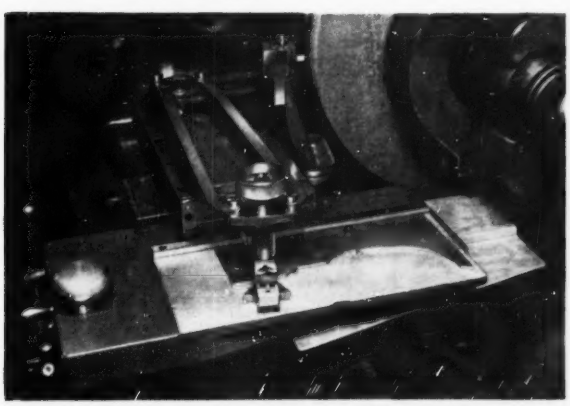
Turbine Shaft Profile dressed with Hoglund Model 40 Dresser on grinder having just sufficient capacity to hold length of the shaft. Would be extremely difficult to dress without the Hoglund Dresser.



Double Ball Race Form on large propeller shaft plunge ground to .0001" tolerance for preload assembly of propeller in hub. Very difficult to dress into the grinding wheel without the Hoglund Model 35 Dresser.



Automatic Hydraulically Operated Dresser, Hoglund Model 35, used on large cylindrical grinder for dressing double ball race form and other contours to .0001" tolerance on 30" diameter, 3½" wide wheels.



Manually Operated Contour Wheel Dresser for flat table universal cylindrical grinders, operated from template enlarged 10 times or 5 times the size of the finished profile. Hoglund Model KB 14-1 or KB 14-2.

We make over 50 different types of contour wheel dressers covering all types of grinders —Surface Grinders, Cylindrical Grinders both plain and universal, Internal Grinders, Special Double Wheel-Head Grinders, Centerless Grinders, etc.

Send us your blueprints and have us submit our recommendations.

HOGLUND

ENGINEERING & MANUFACTURING CO.

Berkeley Heights New Jersey

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist & Drill Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jahn, B. Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Atlantic Gear Works, Inc., 200 Lafayette St., New Cork 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

(Continued on page 466)

High Speed "Controlled Tapping"

New TRU-GRIP Tap Holder

The exclusive Procunier "Tru-Grip" tap holder is lighter, smaller in diameter. It affords easier tapping close to walls or shoulders, eliminates "chewed" tap shanks. Holds tap true.

Saves Taps . . . Stops Spoilage . . .

"Controlled Tapping" is the nearest to automatic tapping perfection yet developed! AND users of Procunier tapping heads have been enjoying this advantage for many years. "Controlled Tapping" action is made possible by a unique, exclusive clutch design. It's the heart of the tapper—and operates with a smooth, sensitive "cushioned action." The tap driving power is automatically regulated by the pressure applied thru the drill press spindle. Large or dull taps require more pressure and driving power than smaller, sharper ones—and "green" as well as experienced operators can quickly detect dull or loaded taps by the "feel" or pressure applied. The acute sensitivity of the clutch results in less tap breakage, fewer spoiled pieces and makes it easier to maintain high production schedules and output.

Important too, the clutch is kept dry—no excess oil reaches the friction surfaces to impair sensitive reaction to tapping pressure which is so necessary for precision tapping at high speeds.

This is only one of the many exclusive features and advantages that have made Procunier Tapping Heads the favorites in the industry. Learn how you, too, can produce more, for less—faster and longer with Procunier.

Write for FREE Brochure

Giving full particulars on the complete line of Procunier Tapping Equipment.

Procunier
Safety Chuck Company
16 S. CLINTON ST., CHICAGO 6, ILL.

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St.,
Chicago 6, Ill.
Dept. 11

Gentlemen: Please send your illustrated brochure giving complete details, specifications and prices on the improved line of Procunier High Speed Tapping Heads.

Name .....
Address .....
City .....Zone....State.....

For more information on products advertised, use Inquiry Card, page 261

NEW
TAFT-PEIRCE *Superpower*
PERMANENT
MAGNET CHUCK

PROVIDES GREATER WORKING SURFACE

An entirely new design, the Taft-Peirce Superpower Permanent Magnet Chuck has 15 to 20% less height than other makes. Provides more clearance between wheel and chuck.

Stronger, yet flexible, too. Just push or pull lever to vary power anywhere from maximum to minimum. Permanently magnetized, power won't fade with use.

Additional poles provide greater working surface.

Ideal for surface grinders, these T-P Chucks are also effective on light millers, planers, shapers. The portable smaller sizes speed hand-finishing, burring, scraping, polishing, inspection operations.

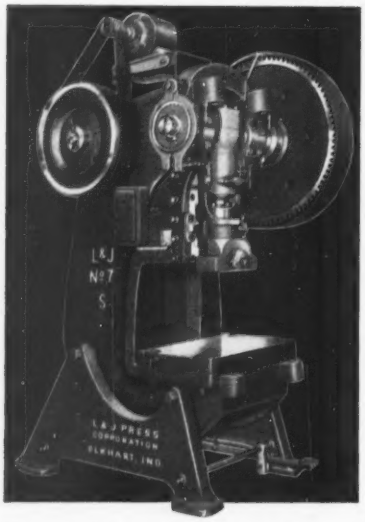
Available in range of sizes. Write for bulletin, today.

T P *T-P means Top Precision*

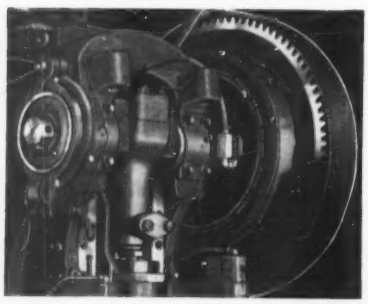
THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND

L&J PRESSES

for Low-Cost Output



The exceptional rigidity and accuracy built into L & J No. 7 Presses is proven by their productivity. Close tolerance work can be consistently produced, longer die life results from proper alignment and minimum deflection. Reports of users show down time and maintenance surprisingly low. Find out now how these presses can improve the quality and volume of your press work at reduced costs.



L&J FAWICK AIR CLUTCH

This clutch, when used with a variable speed drive, provides maximum speed for each operation. Also, more production and greater safety. L & J Air-Release Spring-Set Brake is positive, fast, safe—set automatically if air pressure fails.

Write for Literature

L&J PRESS CORPORATION
1631 STERLING AVENUE
ELKHART, INDIANA

Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schnectady, N. Y.
James, D. O. Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind.
Mullins Manufacturing Corp., Salem, Ohio.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STAMPINGS, Sheet Metal

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Laminated Shim Co., Inc., Glenbrook, Conn.
Mullins Manufacturing Corp., Salem, Ohio.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STAMPS, Steel and Marking Dies

Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co, 208 S. LaSalle t., Chicago 4, Ill.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div. Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.

(Continued on page 468)

For more information on products advertised, use Inquiry Card, page 261

WHAT DOES FIRTH STERLING OFFER YOU?

(ANSWER NUMBER 2)

ONE SOURCE FOR ALL TOOLING NEEDS

THE *RIGHT* STEEL OR CARBIDE . . . THE *EXACT* METALLURGICAL COMBINATION NEEDED TO DO YOUR JOB BEST . . . FROM A SINGLE MANUFACTURING SOURCE

The next time you have a difficult tooling problem we invite you to call in a Firth Sterling man.

He may be called a "tooling specialist" or a "sales engineer" . . . but anyhow he's just a fellow who understands the *cutting*, *shaping* and *forming* of metals like nobody's business. He *may* be a graduate engineer, or he may have learned the hard way on a milling machine, draw bench or press, but he *knows* the score.

He can give you an unbiased recommendation . . . because he has approximately 100 different grades of Firth Sterling high speed steels, and tool and die steels to choose from *and* a dozen grades of tungsten carbide in everything from die nibs to a virtually unlimited variety of standard and special carbide cutting tools and tips.

All this is backed by 64 years of leadership in the development and production of special purpose steels, and 24 years of pioneering in carbide and "powder metallurgy" applications.

It makes sense, that a company which engages in *all* phases of tooling metallurgy will serve your interests best.

Remember, Firth Sterling *is* a single, dependable source for complete shop tooling.

Firth Sterling Stands for Metallurgical Achievement—Past, Present, Future

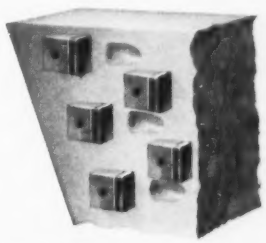
I-2

Cut Inventories with

Standard Firthite Tipped Broach Tools

Now, automobile and other manufacturers can keep broach tool inventories at a minimum and be assured of *off-the-shelf delivery* on *standard* Firthite tipped broach tools and almost equally fast service on "standards" modified to suit individual tooling requirements. Firth Sterling broach tools come in three standard sizes and styles.

The addition of broach tools to the constantly expanding line of *standard* Firthite Carbide Tools is the result of close engineering cooperation with one of the major



broaching machine manufacturers, whose huge new broaching machines are playing such an important part in the mass production of cylinder blocks for today's automobile engines.

The outstanding performance record of these Firthite broach tools has resulted in a continuing demand that enables us to make them stock items. Always specify Firthite broach tools for increased production and economical machining.

Prompt delivery may also be had on solid Firthite finishing blades.

Drop us a line for detailed engineering information or literature. P-11

Firth Sterling

— INC. —

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES* AND WAREHOUSES: BIRMINGHAM* CHICAGO CLEVELAND DAYTON* DETROIT HARTFORD* HOUSTON* LOS ANGELES NEW YORK* PHILADELPHIA* PITTSBURGH* WASHINGTON*

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets

For more information on products advertised, use Inquiry Card, page 261

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel.

STEEL BARS

See Bars, Steel.

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

STONES, Oil or Sharpening

Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STUD SETTERS

Errington Mechanical Laboratory Inc. 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

See Plates, Surface

SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
Control Products, Inc., (Waterproof and Thermo), 306 Sussex St., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

TACHOMETERS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

TAPER PINS, Standard

Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Chicago Screw Co., Bellwood, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Associated Mch. Tool Corp., P. O. Box 9666, 535 McNeilly Rd., Pittsburgh 26, Pa.
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Besly-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O. Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co. New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N.Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(*Continued on page* 470)

150 SQ. IN. OF WORK SURFACE

ABRASIVE NO. 1½ TOOLROOM SURFACE GRINDER—a quality-built hand feed grinder—has the capacity your toolmakers need for their work—nearly 50% more than most small surface grinders. Abrasive No. 1½ is easy to work with—it's a big favorite with toolmakers throughout the world. Thousands of these simple, efficient grinders are in service today—in tool and die shops, and in the tool departments of production plants. Send for Catalog giving complete details. Abrasive Machine Tool Company, 12 Dunellen Road, East Providence 14, R. I.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Reflected in the Finish of Your Product

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
V & O Press Co., Div., Emhart Mfg. Co., Hudson, N. Y.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Lovejoy Tool Co., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Milholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 Wheeler St., Springfield, Ohio.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Kennametal, Inc., Latrobe, Pa.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
OK Tool Co., Milford, N. H.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Metal Corp., Lexington, Ky.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Springfield, Vt.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TRANSFER MACHINES, Automatic

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland.

TUBE MILLS

Abbey-Etna Co., 2422 Maplewood Ave., Toledo 10, Ohio.

TUBING, Aluminum

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

TUBING, Brass and Copper

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

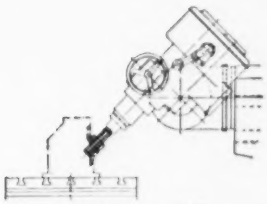
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

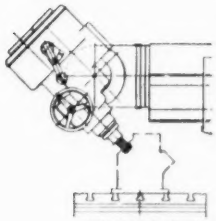
(*Continued on page* 472)

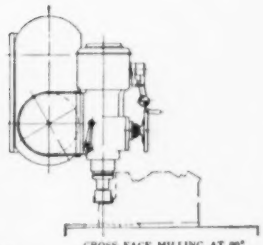
For more information on products advertised, use Inquiry Card, page 261

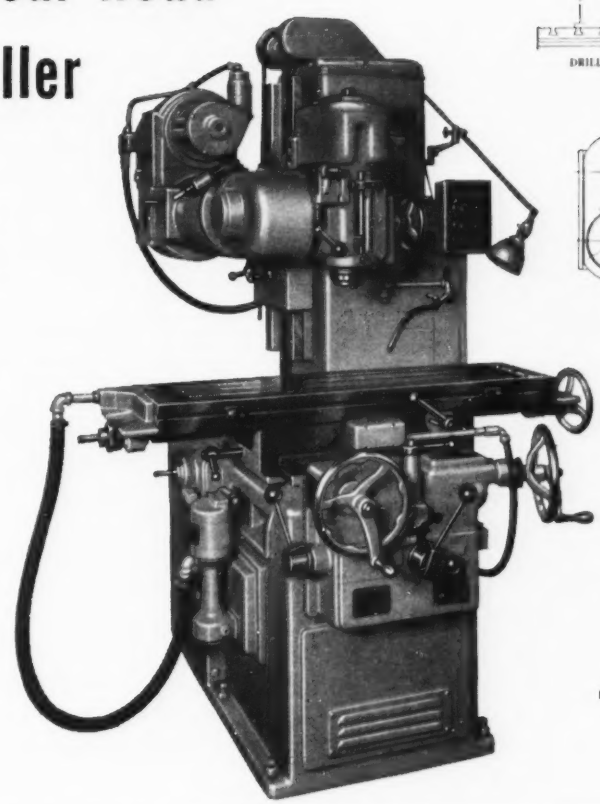
FASTER MILLING...from ANY ANGLE on REED-PRENTICE

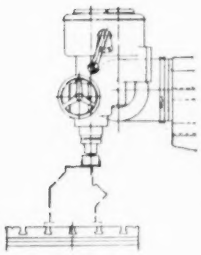
12V Universal Head Vertical Miller

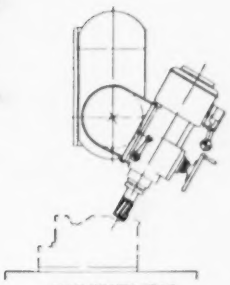

DRILL BORE AND REAM AT 45°


MILLING SLOT AT 45°


CROSS FACE MILLING AT 90°




FACE MILLING AT 90°


CROSS MILLING AT 30°

Universal head on the Reed-Prentice 12V Vertical Miller speeds up milling operations by saving valuable set-up time. Head adjustment up to 45° front and back and 30° left and right permits rapid milling from any angle.

Easy to reach central pushbutton panel gives instant *electronic* control of infinitely variable feeds and spindle speeds. The Reed-Prentice 12V is particularly adapted for machining plastic and rubber molds, die casting dies, forge dies, jigs and fixtures.

Get full details on the versatile 12V Miller now. Send for Bulletin #953.

SPECIFICATIONS

CAPACITY

Max. distance Table to face of spindle	18"
Max. distance Spindle to column	26"
Min. distance Spindle to column	12"

HEAD

Infinite speeds	90 to 2200
#40 NMTBA taper in spindle	
Head swivels (F&B)	45°
(L&R)	30°
Vertical Travel of spindle	5"

RANGE

Longitudinal travel	28"
Cross Travel	12"
Vertical Travel	14"

Size

Working surface	12" x 46"
3 T-Slots (spaced 3")	11/16"

FEEDS: Inches per Min.

Longitudinal	1/4" to 24"
Cross	1/4" to 24"
Vertical of ram	3/32" to 16"

SPINDLE DRIVE MOTOR 3 HP

REED-PRENTICE CORP. — MACHINE TOOLS — WORCESTER MASS., U.S.A.

MAIN OFFICE 677 Cambridge St., Worcester 4, Mass.

BRANCH OFFICES

75 West St., New York 6, N.Y.
1213 West 3rd St., Cleveland 13, Ohio
4001 N. Elston Ave., Chicago 18, Illinois
2842 W. Grand Blvd., Detroit 2, Michigan

MACHINE TOOL REPRESENTATIVES

Philadelphia — Calco Machinery Co.
Buffalo — J. L. Osgood Machinery Corp.
Detroit — DoAll Detroit Co.
Grand Rapids — DoAll Grand Rapids Co.
Minneapolis — Chas. W. Stone Co.
Houston — Preston Machine Tool Sales Co.
San Francisco — Montague-Harris Co.
Los Angeles — King Machinery Co.

For more information on products advertised, use Inquiry Card, page 261

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS

See Drills, Twist.

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

VALVE CONTROLS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Bellows Co., 230 W. Market St., Akron, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr. Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bellows Co., 250 W. Market, Akron, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hendey Machine Co., Inc., Torrington, Conn.
Homestrand, Inc., Larchmont, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

VISES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VISES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, Lock

Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WASHERS, Spring

Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.

American Electric Fusion Corp., 2606 Diversey Ave., W. Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co. 254 Laurel Ave., Des Plaines, Ill.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

WELDMENTS

Mahon, R. C., Co., Detroit 34, Mich.
Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

WIRE

American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

WORM DRIVES

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

WRENCHES

Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.
Cleco Div., Reed Roller Bit Co. (Impact, Pneumatic), 5125 Clinton Ave., Houston 20, Tex.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

WRENCHES, Detachable Socket

Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Pipe

Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.
Peck, Stowe & Wilcox Co., Southington, Conn.

WRENCHES, Ratchet

Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.
Keller Tool Co., Grand Haven, Mich.

WRENCHES, Tap

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

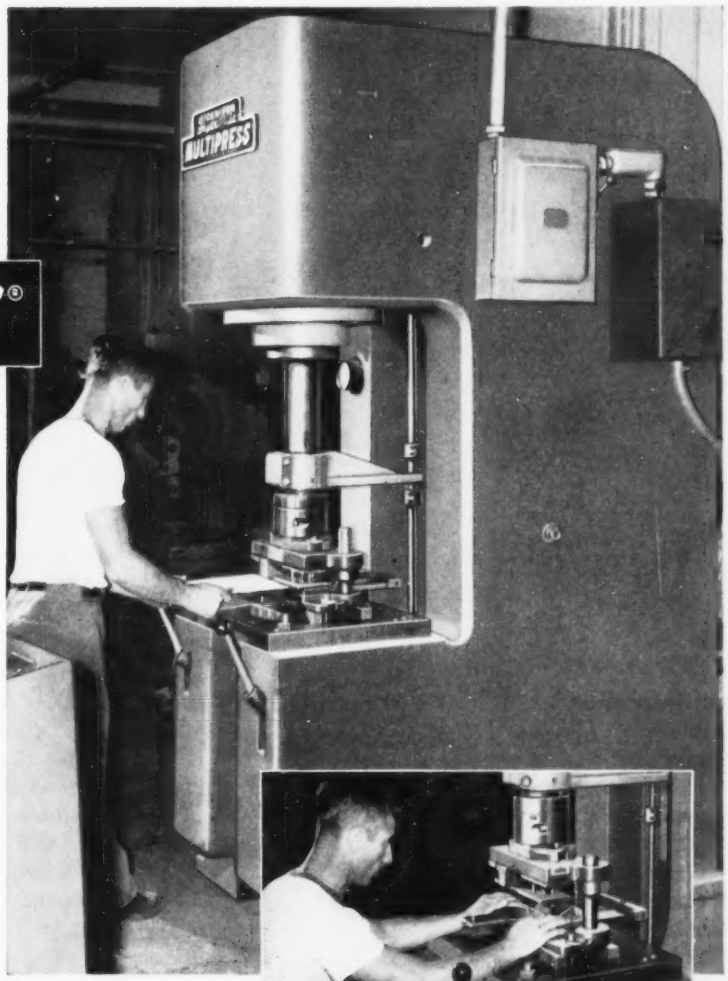
WRENCHES, Torque Measuring

Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.
Sturtevant, P. A., Co., Addison, Ill.

"Paid for itself on 50,000 Parts"

says A. J. Houseman, vice president of Automatic Radio of Boston, in discussing his firm's use of

MULTIPRESS®



Here again, Multipress *paid off fast*—for this manufacturer of radio sets for leading makes of cars.

A 50-ton Multipress blanks, pierces, and draws *cold rolled steel* to form auto radio cabinets and front escutcheon plates that are stronger and better finished than the die-cast parts they replace.

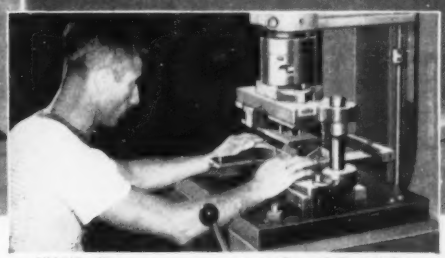
In addition, costs are so much lower that Multipress literally paid for itself on one run of 50,000 parts.

This remarkable saving is made on two operations handled on a 50-ton Multipress. In a single stroke, flat predeveloped blanks of .032 *cold rolled steel* are deep-drawn under 18-ton pressure to the intricate shape shown in Fig. 1 — a job that ordinarily required 2 or 3 separate operations. Later, the same Multipress blanks and pierces the parts as shown from the back, in Fig. 2.

Easy, stepless adjustment of the Multipress ram effort permits pressures to be set just above the point at which dies "break through" the metal. Added to the smooth, *controlled* hydraulic ram action, this cuts "die punishment" to the bone. When dies become dull and fail to break through, they're quickly resharpened with minimum grind-off—hence, *dies last four to five times longer than in the previous method.*

Production speeds now reach 400 per hour on blanking, 1500 per hour on the drawing and forming. On a smaller radio head of .040 chrome plated cold rolled steel, output is up to 2100 parts per hour. Scrap loss is also drastically reduced.

Automatic Radio is now adapting several other jobs to Multipress, with the idea of matching the gains made on these typical examples.



***ABOVE:** Clear, easy access to tooling, full visibility, easy parts-loading from comfortable sitting position, and dual safety controls make Multipress popular for easy operation as well as for cost-cutting efficiency.*
***BELOW:** Two views of a part that is first deep-drawn, then blanked and pierced, on a 50-ton Multipress that paid for itself in reduced costs on only 50,000 parts.*

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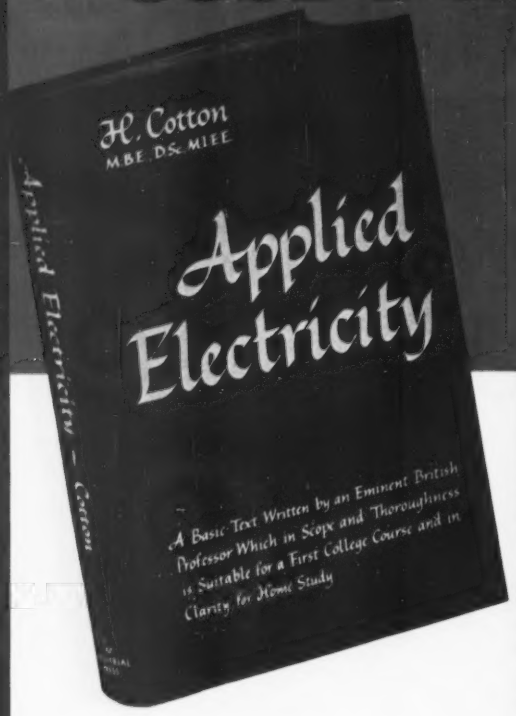
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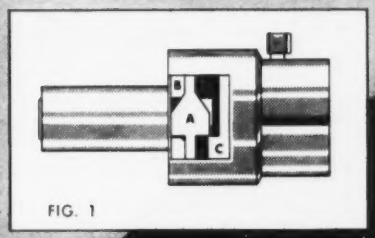
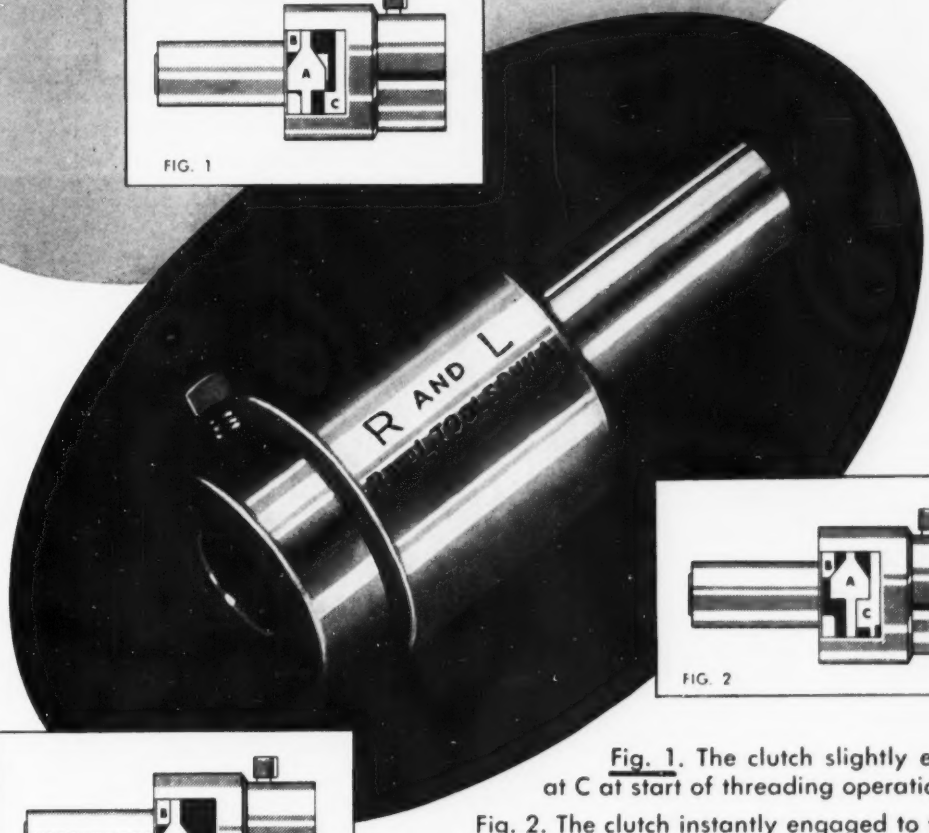


FIG. 1



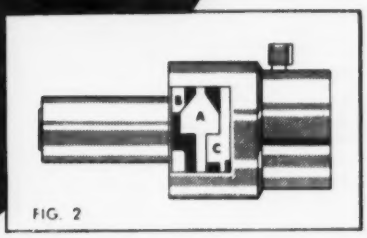


FIG. 2

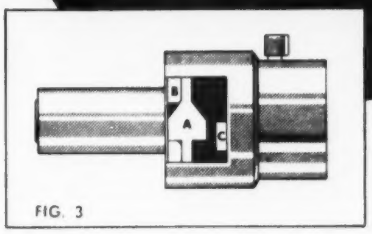


FIG. 3

Fig. 1. The clutch slightly engaged at C at start of threading operation.

Fig. 2. The clutch instantly engaged to full contact between A and C at moment tap or die engages work.

Fig. 3. Fully released, there is ample clearance between clutch's contact points.

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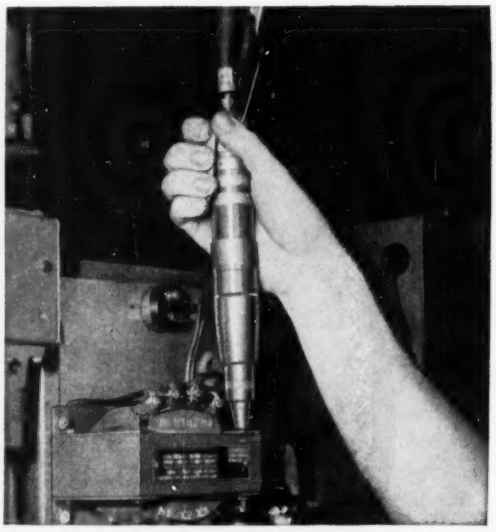

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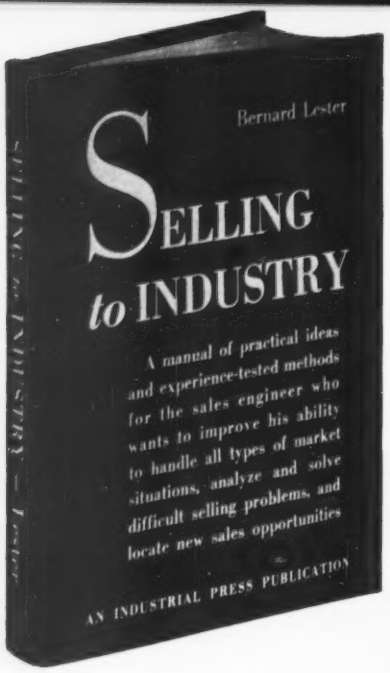
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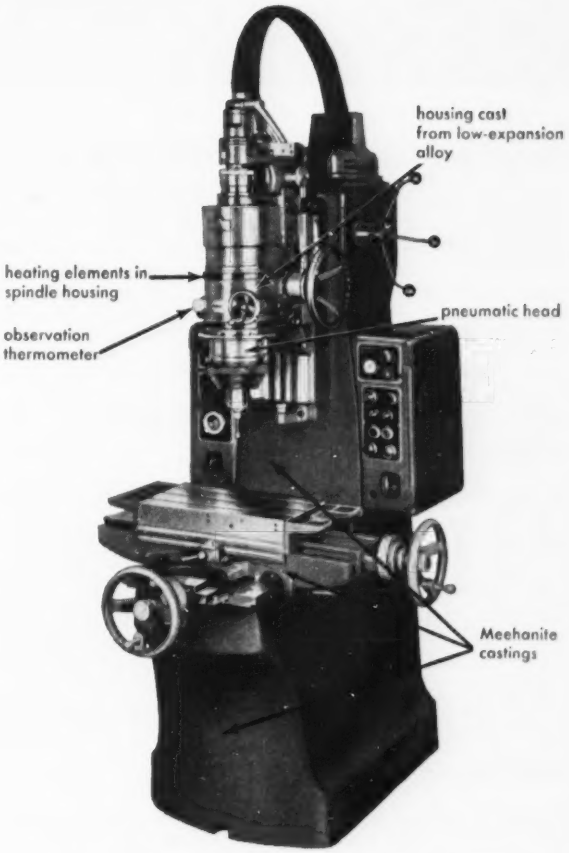

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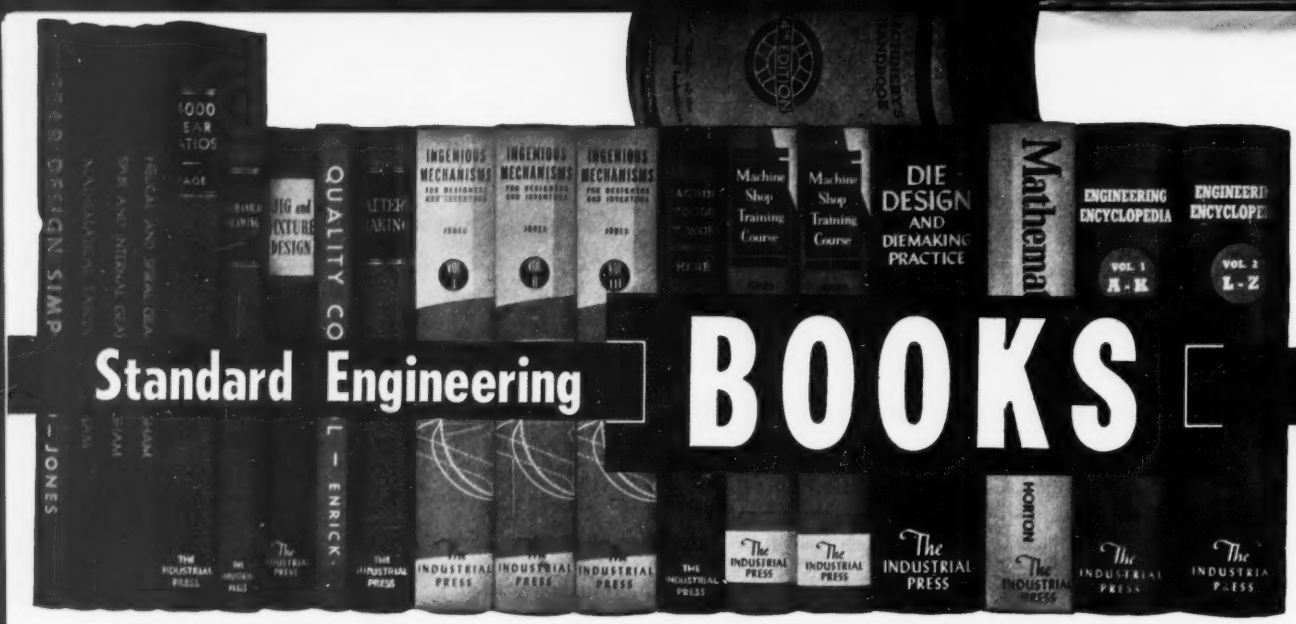

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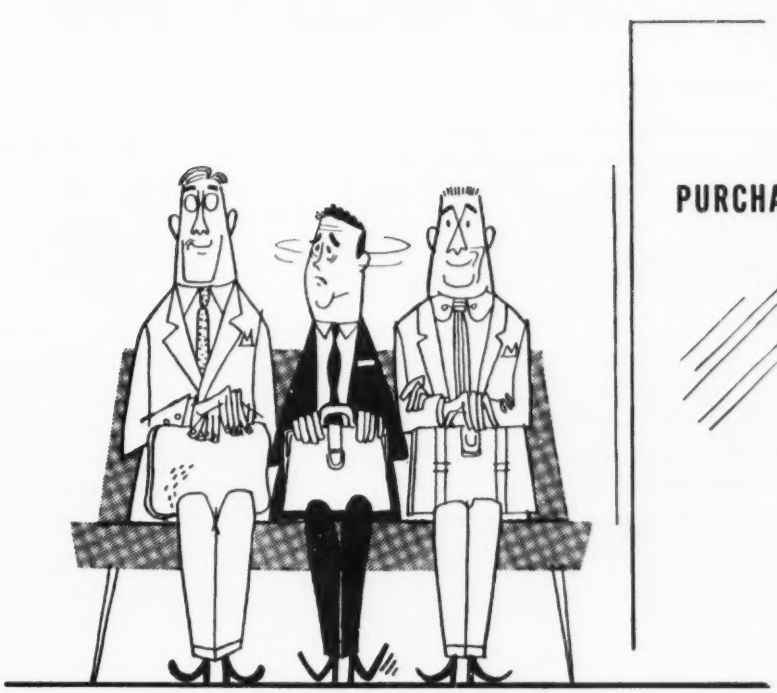

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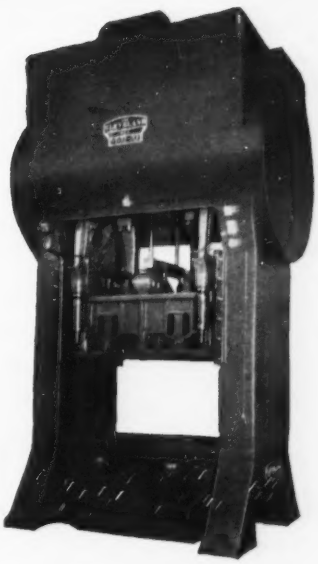

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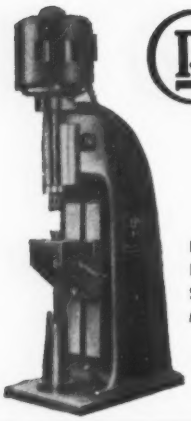

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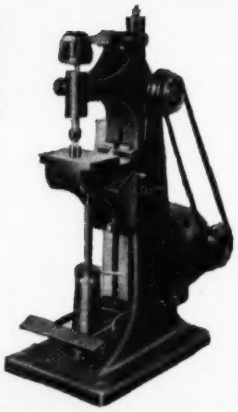

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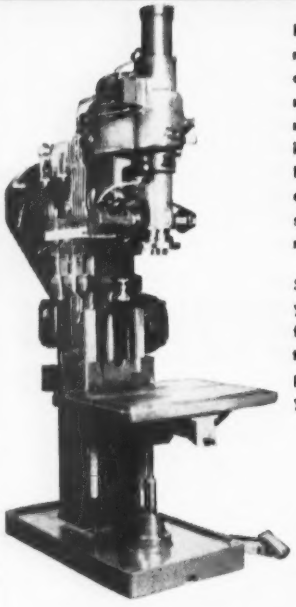

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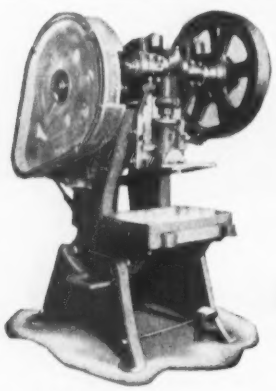

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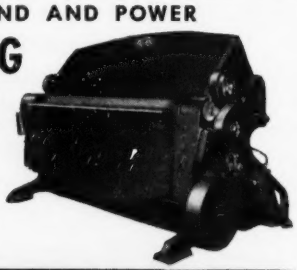

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Special Bending Brakes
Double Folder Brakes

DREIS & KRUMP MANUFACTURING COMPANY

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CHICAGO

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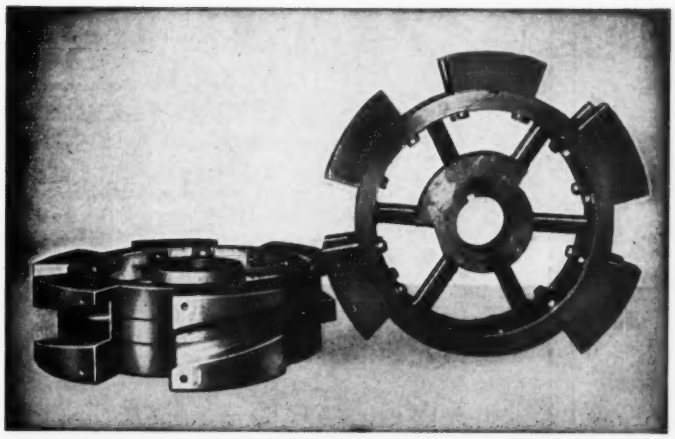
Rowbottom for Cams



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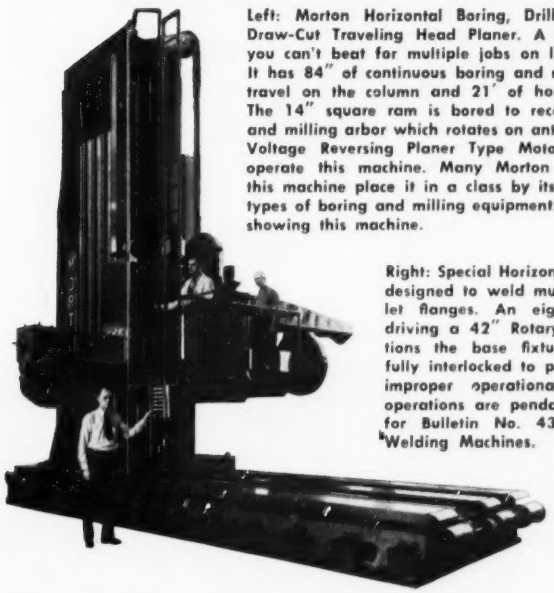
Cams — and cams only! That is why it pays to let Rowbottom handle your problems of cam design and production. Our entire facilities are devoted to cam manufacture only and our experience in this particular field makes Rowbottom the logical choice whenever you need cams.

- The cam illustrated—made of interchangeable steel segments—is an example of Rowbotton service in designing and manufacturing cams for unusual applications. For every cam, whatever the material, size, type, or function, get Rowbottom estimates first!

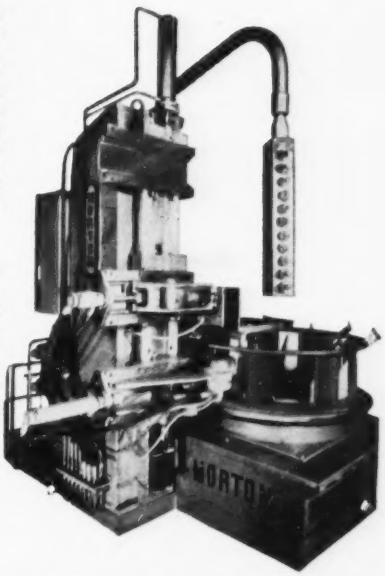
THE ROWBOTTOM MACHINE CO., Waterbury, Conn., U. S. A.

Morton Draw-Cut Machine Tools and Special Machinery
Welding Machines for Submerged and Inert Arc



Left: Morton Horizontal Boring, Drilling, Milling Machine and Draw-Cut Traveling Head Planer. A Combination Machine Tool you can't beat for multiple jobs on light and heavy production. It has 84" of continuous boring and milling feed, 10' of vertical travel on the column and 21' of horizontal travel on the bed. The 14" square ram is bored to receive a 7" diameter boring and milling arbor which rotates on anti-friction bearings. Variable Voltage Reversing Planer Type Motors and Control Equipment operate this machine. Many Morton attachments applicable to this machine place it in a class by itself as far superior to other types of boring and milling equipment. Send for Bulletin No. 37-E showing this machine.

Right: Special Horizontal Index Welding Machine designed to weld multiple jet burner plate eyelet flanges. An eight-station hydraulic index driving a 42" Rotary Table supports and positions the base fixture. The entire machine is fully interlocked to protect against accidental or improper operational sequence. All machine operations are pendant station controlled. Send for Bulletin No. 43-E covering Morton Girth Welding Machines.



We also build Stake, Girth, Combined Press and Girth, Angular Girth and Special Welding Machines which will efficiently serve your needs.

MORTON FINISHED MACHINE KEYS

Gib Head—Plain—Feather—Hi-Pro—Woodruff

Machine Tool Precision is Processed into Each Key

MORTON MANUFACTURING CO.

Send for Bulletin 43-E.

MUSKEGON HEIGHTS, MICHIGAN

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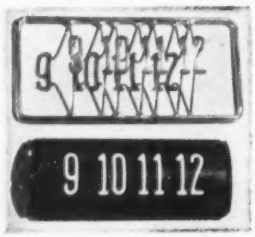
ENORMOUS SAVINGS IN COLOR DECORATION OF 3-DIMENSIONAL PARTS

ELECTRO-FORMED METAL SPRAY PAINTING MASKS

(Made by Patented Process)

Permit rapid wet painting, one color after another. Clean, sharply defined letters and decorative effects obtained on intricate die castings, stampings and plastic forms by accurate control of painted areas. No fogged edges. After-wiping or buffing-off of over-spray unnecessary. The "loose" inside of letters and numerals, such as "O" and "6", is held in position by arched bridging to eliminate objectionable "ties". Plug-type masks [keep depressed areas clear, while spraying background]; lip-type masks [protect background while painting depressed areas]; and block-cutout, plane-surface type masks.



Foot treadle air-operated clamps, fixtures and tools which position and hold the piece snugly in the mask; and permit the operator to use both hands.

We design, engineer and build automatic, entirely air-operated machines for spray decorating a variety of small parts at speeds of up to 3600 per hour. Masks inserted flush with top of work table. Spraying is from below. Dials regulate cycling speed and amount of paint sprayed. The same amount of paint is sprayed on every part, regardless of speed of loading cycle. Effect paint savings up to 50% over hand spraying. Employ automatic guns and air agitated paint pressure tanks with insert containers.

AUTOMATIC, ROTARY-INDEXING PAINTING MACHINE

Completely air-operated or actuated by electric-motor Geneva drive. Machine illustrated has 24 work-holders and indexes 12 times per each complete revolution of the table. The part cavity is eight inches deep and the painting is accomplished on the return stroke, with the work being revolved by a variable-speed air drive.

Speed of stroke during painting regulated by convenient dial. Speed of indexing dial controlled to paint from 400 to 1200 pieces per hour, two at a time. Continuous, circulating paint system. Can be supplied with hot-spray equipment if desired. Built for 4-, 6-, 8-, 12- or 24-station indexes or continuous movement.

We also manufacture mask washing equipment.

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CONFORMING MATRIX CORPORATION

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Please send without obligation, details on [ ] Automatic Rotary Indexing Painting Machines; [ ] Automatic Single-Spindle Painting Machines; [ ] Hand Masks; [ ] Mechanical Masking Fixtures; [ ] Air-Operated Masking Fixtures; [ ] Stationary, Automatic Spray-Painting Masking Machines; [ ] Rotary Table, Automatic, Spray-Painting Masking Machines; [ ] Mask-Washing Equipment.[ ] Quotations on masks for parts [or prints] which I am forwarding.

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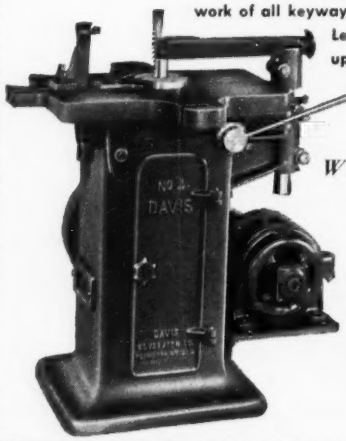
QUICK, LOW COST OPERATION is made possible by the Davis tilting table, which permits even work tapering as much as 3" per foot to be set up and cut quickly. And Davis multiple tooth cutters make quick work of all keyways up to 1" in width. Let us work out set-ups to speed up your production.



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LIFT AND CARRY WITH MORGAN CRANES

When you speed up parts and materials handling you lower costs! Morgan Cranes can handle every transportation assignment in your shop—safely, economically and efficiently. Call on Morgan when you have a lifting or carrying problem.

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MOLINE "Hole-Hog" SPECIALLY DESIGNED MACHINE TOOLS

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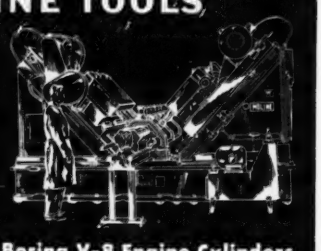

Boring V-8 Engine Cylinders

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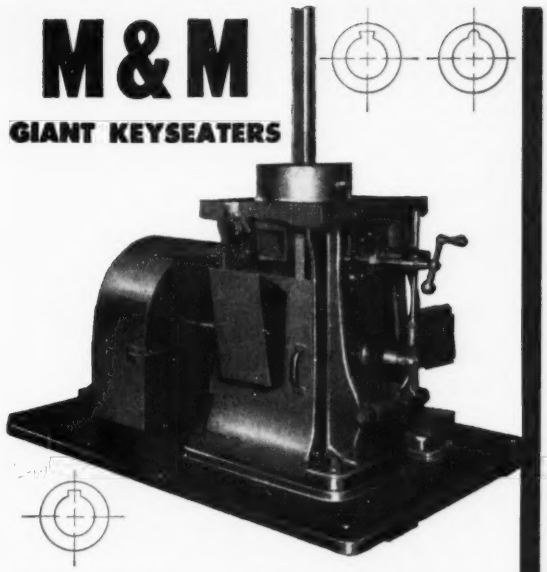
M&M

GIANT KEYSEATERS



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for Greater Production

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No. 4 Universal
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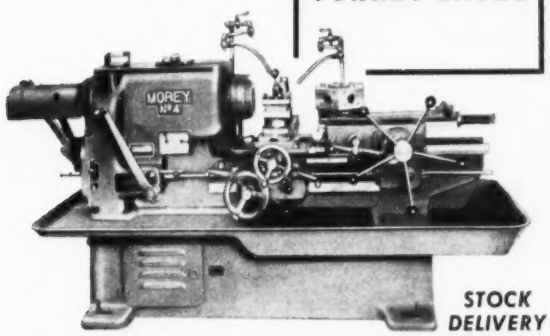

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PARTIAL SPECIFICATIONS

Bar work capacity	2" x 12"
Chucking capacity	2"
Swing over bed	19½"
Hole through spindle	2-13/32"
Spindle speeds (back gear ratio)	From 35 to 1500 RPM.
Infinite variations with constant speed, AC motor 1:7.2	1200 RPM.
Motor	7½" HP.
Supplied with hardened steel bedways.	

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Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

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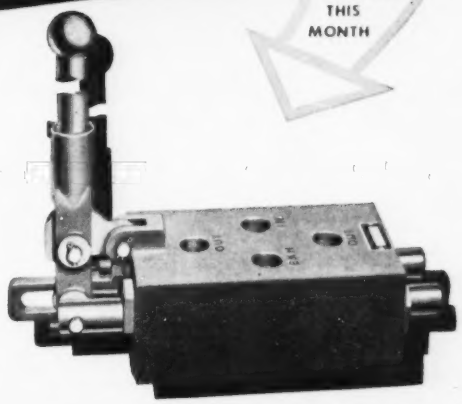

Lever Operated Hydraulic Valves

For line pressures up to 5000 psi

● Unsurpassed for efficient trouble-free service controlling single or double acting hydraulic cylinders and other important high pressure hydraulic circuits. Positive, fast acting. All parts are in pressure balance, eliminating any tendency to creep or crawl. Machined steel housings, with chrome plated and polished stainless steel plungers. Self sealing U-packers. Metal valving rings take the impingement of the liquid, minimizing wear on the packings. ¼" to 1½" sizes. Also available in pilot operated designs; sizes to 4". Write for details.

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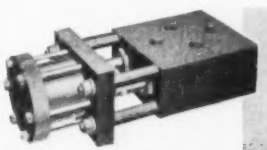

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Two position valves 1½" to 4" sizes for line pressures from 1000 to 5000 psi. Valve is placed close to the work and operated from a central control point with an easy to handle air valve avoiding operator fatigue.

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Send for Woody Spencer's Handy Tapping Guide . . . all arranged for quick easy tapping reference. IT'S FREE! Hangs on wall or lies flat on desk.

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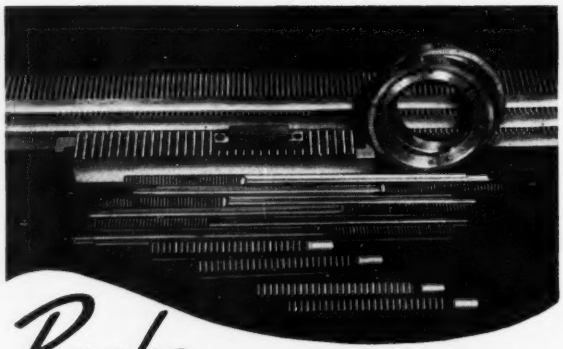

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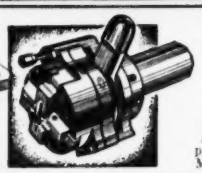

famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

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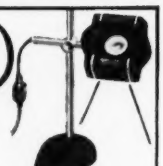

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CAPACITY 20" DIA. 5 D. P.

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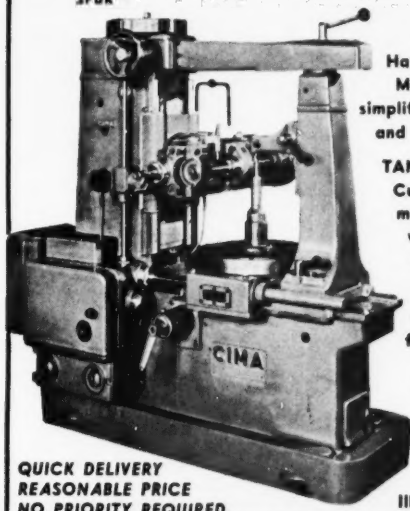

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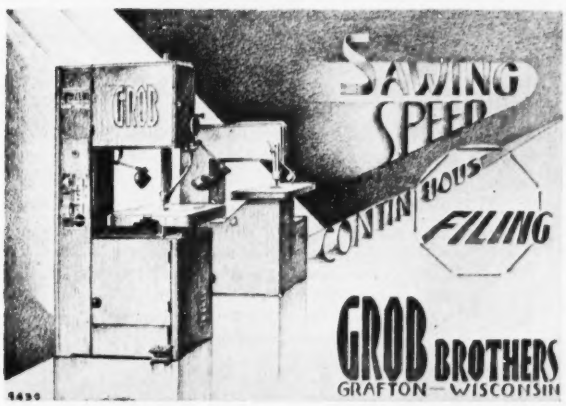

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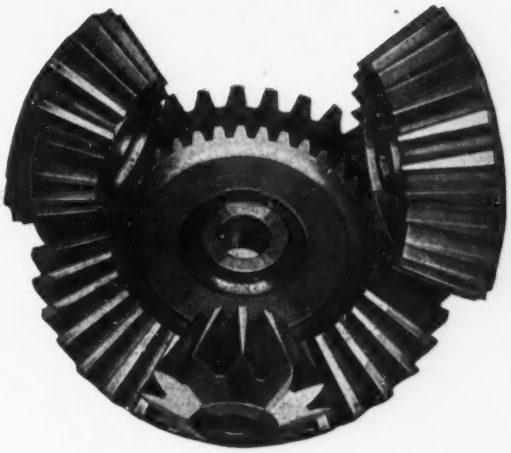

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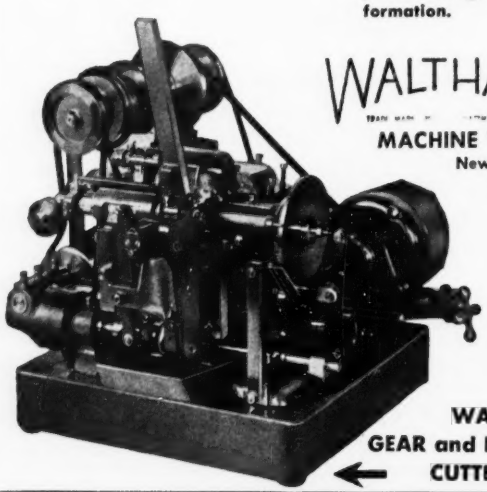

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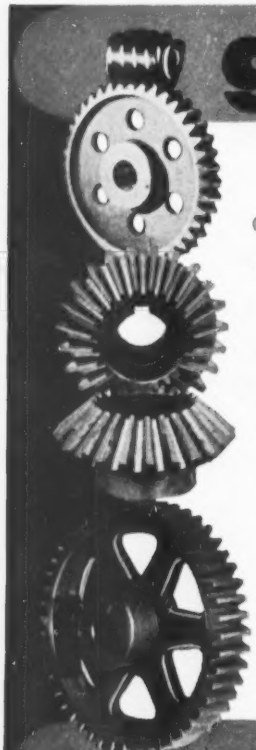

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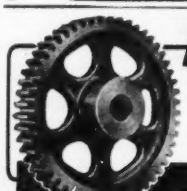

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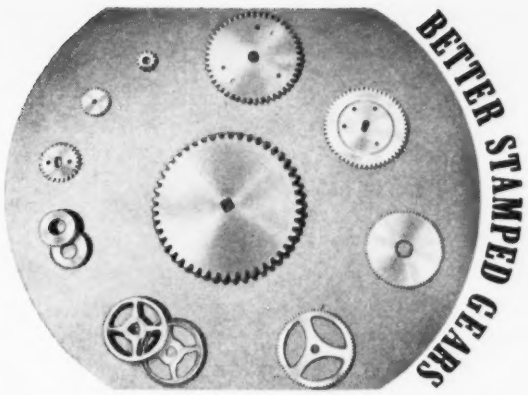

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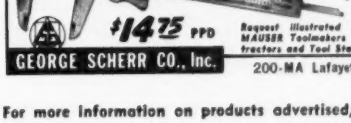

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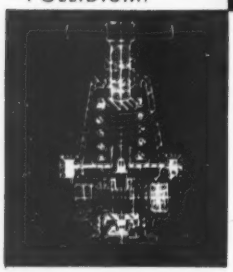

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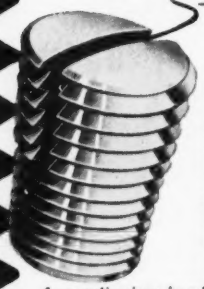

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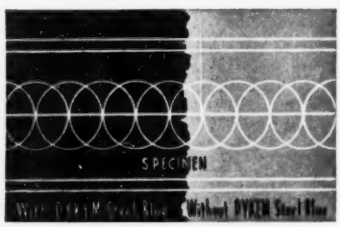

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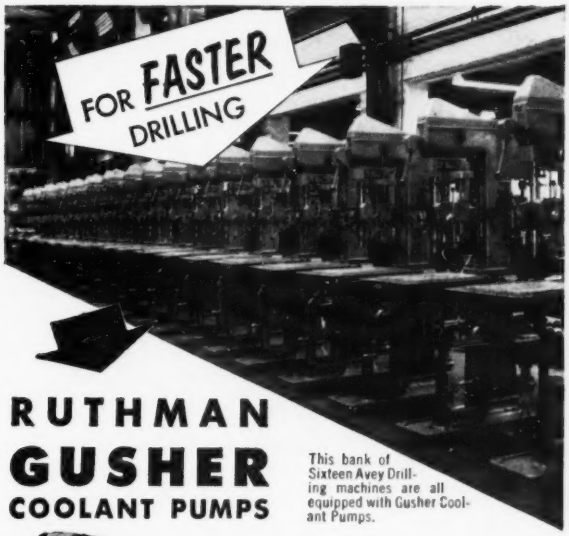

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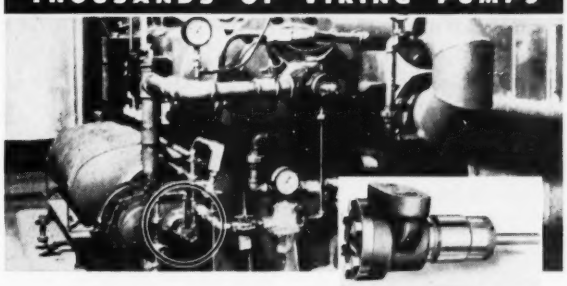

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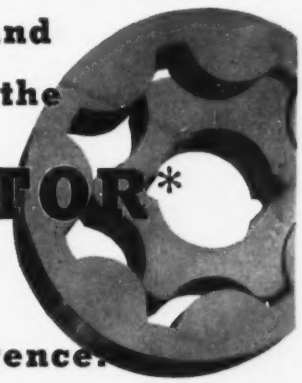

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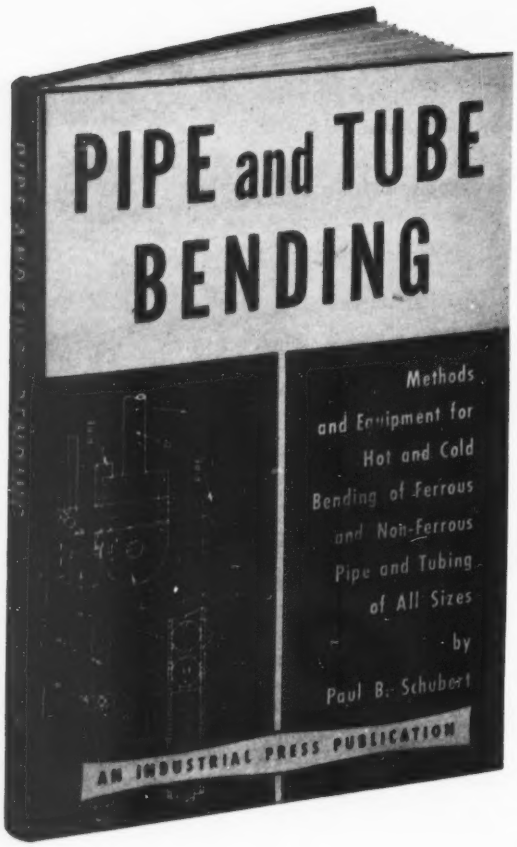
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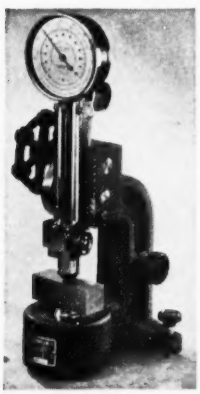

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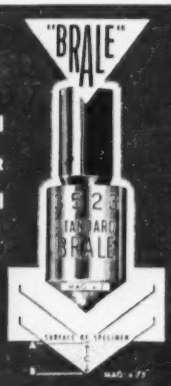

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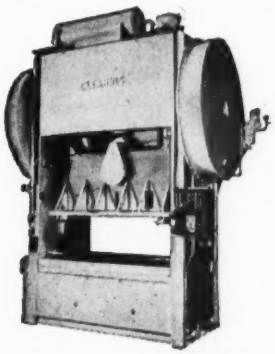

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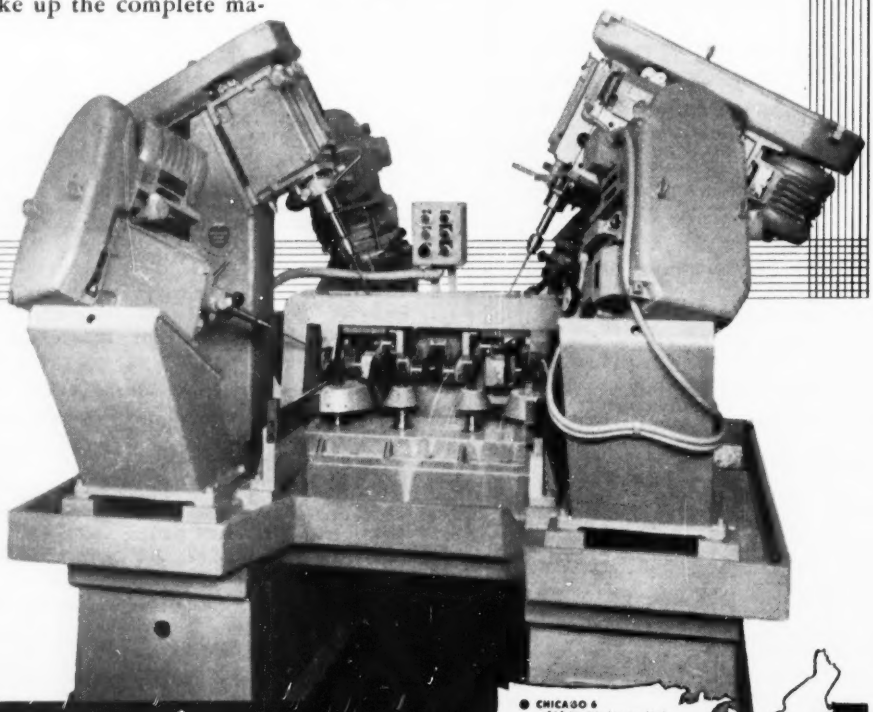

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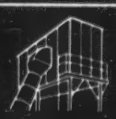

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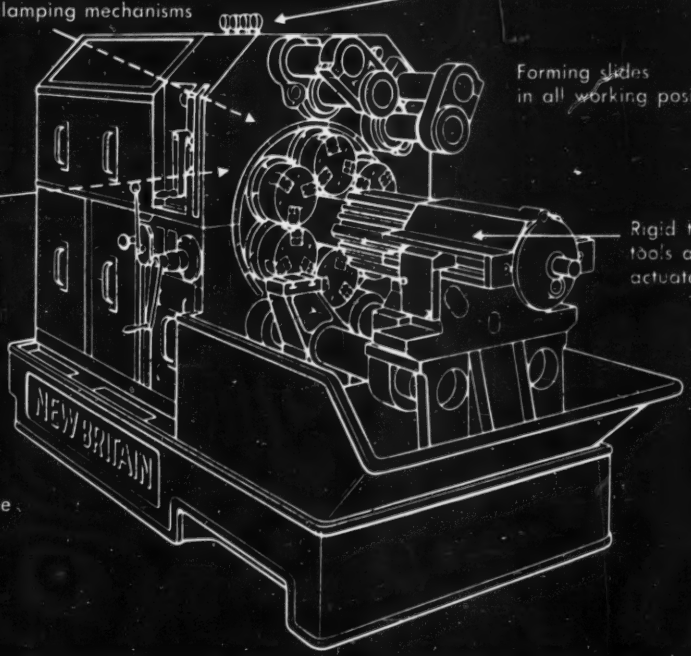
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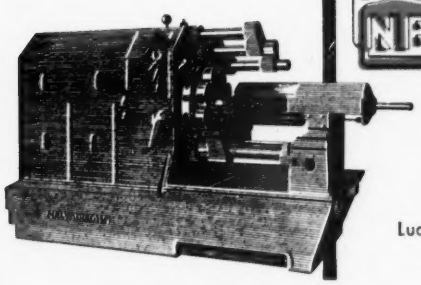

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